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07 AIRCRAFT PROPULSION AND POWER 2236

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20 SPACECRAFT PROPULSION AND POWER 2243

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SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences.*

88 SPACE SCIENCES (GENERAL) 2397

89 ASTRONOMY 2397
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 2398
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 2400
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance.* For space stations see *15 Launch Vehicles and Space Vehicles.*

92 SOLAR PHYSICS 2400
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 2407
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine.* For theory see *73 Nuclear and High-Energy Physics.*

GENERAL

99 GENERAL 2407

Note: N.A. means that no abstracts were assigned to this category for this issue.

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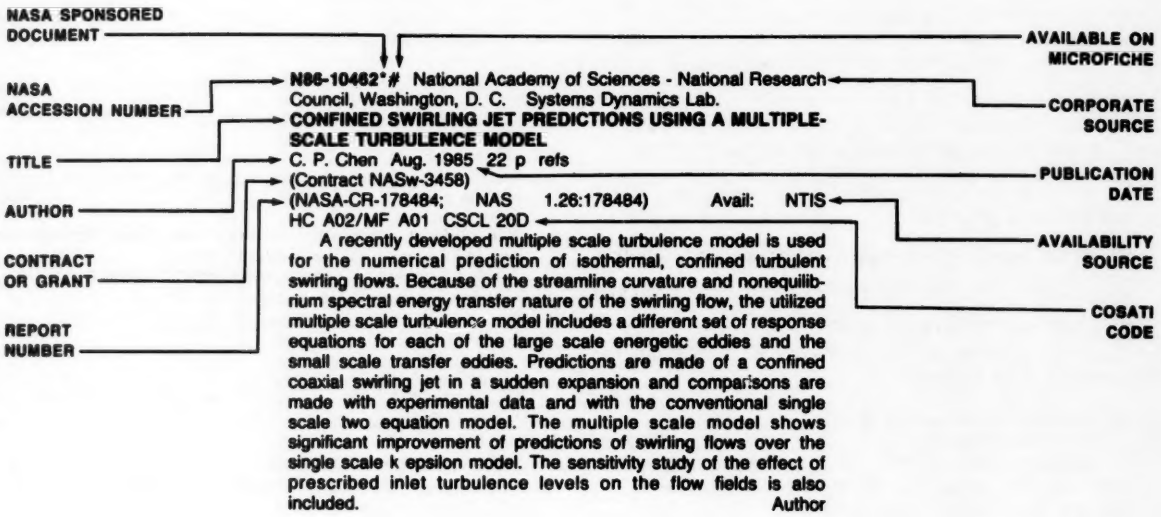
TYPICAL CITATION AND ABSTRACT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N86-10482*# National Academy of Sciences - National Research Council, Washington, D. C. Systems Dynamics Lab.
CORPORATE SOURCE
TITLE
CONFINED SWIRLING JET PREDICTIONS USING A MULTIPLE-SCALE TURBULENCE MODEL
AUTHOR
C. P. Chen Aug. 1985 22 p refs
PUBLICATION DATE
CONTRACT OR GRANT
(Contract NASw-3458)
REPORT NUMBER
(NASA-CR-178484; NAS 1.26:178484) Avail: NTIS
AVAILABILITY SOURCE
HC A02/MF A01 CSCL 20D
COSATI CODE
A recently developed multiple scale turbulence model is used for the numerical prediction of isothermal, confined turbulent swirling flows. Because of the streamline curvature and nonequilibrium spectral energy transfer nature of the swirling flow, the utilized multiple scale turbulence model includes a different set of response equations for each of the large scale energetic eddies and the small scale transfer eddies. Predictions are made of a confined coaxial swirling jet in a sudden expansion and comparisons are made with experimental data and with the conventional single scale two equation model. The multiple scale model shows significant improvement of predictions of swirling flows over the single scale k epsilon model. The sensitivity study of the effect of prescribed inlet turbulence levels on the flow fields is also included.
Author

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Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERONAUTICS (GENERAL)

N86-23552* National Aeronautics and Space Administration, Washington, D.C.
A CUMULATIVE INDEX TO A CONTINUING BIBLIOGRAPHY ON AERONAUTICAL ENGINEERING
1986 521 p
(NASA-SP-7037(196); NAS 1.21:7037(196)) Avail: NTIS HC A22 CSCL 01A

This bibliography is a cumulative index to the abstracts contained in NASA-SP-7037(184) through NASA-SP-7037(195) of Aeronautical Engineering: A Continuing Bibliography. NASA SP-7038 and its supplements have been compiled through the cooperative efforts of the American Institute of Aeronautics and Astronautics (AIAA) and the National Aeronautics and Space Administration (NASA). This cumulative index includes subject, personal author, corporate source, foreign technology, contract, report number, and accession number indexes. Author

N86-23553* National Aeronautics and Space Administration, Washington, D.C.
AERONAUTICAL ENGINEERING (A CONTINUING BIBLIOGRAPHY WITH INDEXES)
Mar. 1986 115 p
(NASA-SP-7037(198); NAS 1.21:7037(198)) Avail: NTIS HC A06 CSCL 01A

This bibliography lists 395 reports, articles, and other documents introduced into the NASA scientific and technical information system in February 1986. Author

N86-23554*# Kentron International, Inc., Hampton, Va.
AN AERODYNAMIC ANALYSIS COMPUTER PROGRAM AND DESIGN NOTES FOR LOW SPEED WING FLAP SYSTEMS Final Report
Harry W. Carlson and Kenneth B. Walkley Washington NASA Mar. 1983 75 p refs
(Contract NAS1-16000)
(NASA-CR-3675; NAS 1.26:3675) Avail: NTIS HC A04/MF A01 CSCL 01B

The expanded capabilities for analysis and design of low speed flap systems afforded by recent modifications of an existing computer program is described. The program provides for the simultaneous analysis of up to 25 pairs of leading-edge and trailing-edge flap deflection schedules. Among other new features of the program are a revised attainable thrust estimation method to provide more accurate predictions for low Mach numbers, and a choice of three options for estimation of leading-edge separation vortex flow effects. Comparison of program results with low speed experimental data for an arrow wing supersonic cruise configuration with leading-edge and trailing-edge flaps showed good agreement over most of the range of flap deflections. Other force data comparisons and an independent study of airfoil and wing pressure distributions indicated that wind-tunnel measurements of the aerodynamic performance of twisted and cambered wings and wings with leading-edge flaps can be very sensitive to Reynolds number effects. Author

N86-23555*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SOME LESSONS LEARNED WITH WIND TUNNELS
M. Leroy Spearman Mar. 1986 40 p refs
(NASA-TM-87710; NAS 1.15:87710) Avail: NTIS HC A03/MF A01 CSCL 01B

A review is presented of some of the lessons learned from wind tunnel tests since World War II. Wind tunnels achieved a very high productivity rate during the war due in part to development testing of numerous military aircraft concepts. Following the war, in addition to development testing, a rapid increase in basic research testing occurred in order to explore areas of interest revealed by the conduct of war and to expand on advanced technology that became available from Germany and Italy. The research test areas discussed are those primarily related to the transition from subsonic flight to supersonic flight. Author

N86-23556# RAND Corp., Santa Monica, Calif.
DEPOT MAINTENANCE OF AVIATION COMPONENTS: CONTRACTOR VERSUS ORGANIC REPAIR
L. B. Embry, N. Y. Moore, J. Cave, and F. LaBrune Mar. 1985 116 p
(Contract N00014-83-C-0100)
(AD-A162071; RAND/N-2225-Navy) Avail: NTIS HC A06/MF A01 CSCL 01/3

Aviation and engine component repair requirements make up over half of the projected wartime depot-level maintenance workload. Organic (service-owned) ability to support this workload is particularly limited; at present, nearly half of the Navy's depot-level component repair is performed in contractor or other service facilities. Before major investments are made in the facilities and equipment needed to accomplish these repairs, it will be necessary to determine the appropriate mix of organic and contractor repair sources. This note addresses the economic and operational implications of alternative source-of-repair decisions. Based on analyses of the distribution of projected wartime demands, technical data limitations, the structure of the repair industry, the operational payoff of facilities characterized by broad scope of repair, and airline industry practices, it postulates a strategy for providing depot-level component support that can be used to specify the appropriate source of repair at different points in the weapon system and subsystem life cycle. GRA

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N86-23557 Department of the Air Force, Washington, D.C.
MULTIPLE JET BLOWING AROUND THE BLUNT TRAILING

EDGE OF A CIRCULATION CONTROLLED AIRFOIL Patent
John K. Harvell and Milton E. Franke, inventors (to Air Force) Issued 26 Nov. 1985 5 p Supersedes AD-D010872 (AD-D012079; US-Patent-4,555,079; US-Patent-Appl-SN-566753) Avail: US Patent and Trademark Office CSCL 01/3

A circulation controlled airfoil has a body structure with leading and trailing ends and upper and lower surfaces extending therebetween, and a cylindrical member disposed along the trailing end of the body structure between the upper and lower surfaces thereof so as to form a rounded, blunt trailing edge surface on the airfoil. A first blowing jet slot is defined between the outer surface of the cylindrical member and the trailing end of the body structure adjacent its upper surface. A second blowing jet slot is defined in a tubular wall of the cylindrical member. The latter member can be rotated to vary the distance of the second jet slot from the first jet slot and thereby adjust the point of separation of air flow along the airfoil from the outer surface of the blunt trailing edge surface formed by the cyclindrical member. In such manner the lift generated by the airfoil can be optimized by providing blowing that is specifically tailored to given flight conditions. Also, the separate plenums are provided for supplying air flow to the respective jet slots. GRA

N86-23558*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
MACH 6 FLOW FIELD SURVEYS BENEATH THE FOREBODY OF AN AIRBREATHING MISSILE
Patrick J. Johnson and James L. Hunt Mar. 1986 155 p refs (NASA-TP-2491; L-15973; NAS 1.60:2491) Avail: NTIS HC A08/MF A01 CSCL 01A

Wall static, local stream static, and pitot pressure surveys were made on the windward side of a hypersonic airbreathing missile at full-scale length Reynolds numbers. In the inviscid part of the flow field, the experimental massflow ratios agreed with trends predicted by a three-dimensional method-of-characteristics solution. At a longitudinal station 3.5 diameters downstrea of the nose, the boundary layer was transitional or turbulent at zero incidence but became laminar as the angle of attack increased. The bell-shaped distribution of the boundary layer across the width of the body affected the mass flow distribution out to the bow shock and decreased the mass flow available the engine inlet. Author

N86-23559*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
STATIC INVESTIGATION OF TWO STOL NOZZLE CONCEPTS WITH PITCH THRUST-VECTORING CAPABILITY
Mary L. Mason and James R. Burley, II Apr. 1986 57 p refs (NASA-TP-2559; L-165052; NAS 1.60:2559) Avail: NTIS HC A04/MF A01 CSCL 01A

A static investigation of the internal performance of two short take-off and landing (STOL) nozzle concepts with pitch thrust-vectoring capability has been conducted. An axisymmetric nozzle concept and a nonaxisymmetric nozzle concept were tested at dry and afterburning power settings. The axisymmetric concept consisted of a circular approach duct with a convergent-divergent nozzle. Pitch thrust vectoring was accomplished by vectoring the approach duct without changing the nozzle geometry. The nonaxisymmetric concept consisted of a two dimensional convergent-divergent nozzle. Pitch thrust vectoring was implemented by blocking the nozzle exit and deflecting a door in the lower nozzle flap. The test nozzle pressure ratio was varied up to 10.0, depending on model geometry. Results indicate that both pitch vectoring concepts produced resultant pitch vector angles which were nearly equal to the geometric pitch deflection angles. The axisymmetric nozzle concept had only small thrust losses at the largest pitch deflection angle of 70 deg., but the two-dimensional convergent-divergent nozzle concept had large performance losses at both of the two pitch deflection angles tested, 60 deg. and 70 deg. Author

N86-23560*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
STATIC INTERNAL PERFORMANCE OF A THRUST VECTORING AND REVERSING TWO-DIMENSIONAL CONVERGENT-DIVERGENT NOZZLE WITH AN AFT FLAP
Richard J. Re and Laurence D. Leavitt Apr. 1986 113 p refs (NASA-TP-2549; L-16025; NAS 1.60:2549) Avail: NTIS HC A06/MF A01 CSCL 01A

The static internal performance of a multifunction nozzle having some of the geometric characteristics of both two-dimensional convergent-divergent and single expansion ramp nozzles has been investigated in the static-test facility of the Langley 16-Foot Transonic Tunnel. The internal expansion portion of the nozzle consisted of two symmetrical flat surfaces of equal length, and the external expansion portion of the nozzle consisted of a single aft flap. The aft flap could be varied in angle independently of the upper internal expansion surface to which it was attached. The effects of internal expansion ratio, nozzle thrust-vector angle (-30 deg. to 30 deg., aft flap shape, aft flap angle, and sidewall containment were determined for dry and afterburning power settings. In addition, a partial afterburning power setting nozzle, a fully deployed thrust reverser, and four vertical takeoff or landing nozzle, configurations were investigated. Nozzle pressure ratio was varied up to 10 for the dry power nozzles and 7 for the afterburning power nozzles. Author

N86-23561*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
AERODYNAMIC CHARACTERISTICS OF A SUPERSONIC FIGHTER AIRCRAFT MODEL AT MACH 0.40 TO 2.47
Francis J. Capone, E. Ann Bare, and Dorothy Arbiter (George Washington Univ., Hampton, Va.) Apr. 1986 105 p refs (NASA-TP-2580; L-16017; NAS 1.60:2580) Avail: NTIS HC A06/MF A01 CSCL 01A

The aerodynamic characteristics of an advanced twin-engine fighter aircraft designed for supersonic cruise have been studied in the Langley 16-Foot Transonic Tunnel and the Lewis 10- by 10-Foot Supersonic Tunnel. The objective of this investigation was to establish an aerodynamic data base for the configuration with flow-through nacelles and representative inlets. The use of a canard for trim and the effects of fairing over the inlets were assessed. Comparisons between experimental and theoretical results were also made. The theoretical results were determined by using a potential vortex lift code for subsonic speeds and a linear aerodynamic code for supersonic speeds. This investigation was conducted at Mach numbers from 0.40 to 2.47, at angles of attack from 0 deg to about 20 deg, and at inlet capture ratios of about 0.5 to 1.4. Author

N86-23562*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
EFFECTS OF UPPER-SURFACE NACELLES ON LONGITUDINAL AERODYNAMIC CHARACTERISTICS OF HIGH-WING TRANSPORT CONFIGURATION
Lawrence E. Putnam Apr. 1986 70 p refs (NASA-TP-2579; L-16062; NAS 1.60:2579) Avail: NTIS HC A04/MF A01 CSCL 01A

An investigation has been conducted in the Langley 16-Foot Transonic Tunnel to determine the effects of installing and streamline contouring upper-surface nacelles on the longitudinal aerodynamic characteristics of a high-wing transport configuration. Also investigated were the effects of adding a fairing under the nacelle. The investigation was conducted at free-stream Mach numbers from 0.60 to 0.83 at angles fo attack from -2 deg to 4 deg. Flow-through nacelles were used. Streamline contouring the nacelles substantially reduced the interference drag due to installing the nacelles. Author

N86-23563*# Sverdrup Technology, Inc., Cleveland, Ohio.
AN LU IMPLICITY SCHEME FOR HIGH SPEED INLET ANALYSIS Final Report
Seokkwan Yoon and Antony Jameson (Princeton Univ., N.J.) Apr. 1986 17 p refs Prepared for presentation at the 22nd Joint Propulsion Conference, Huntsville, Ala., 16-18 Jun. 1986; cosponsored by AIAA, ASME, SAE, ASEE

(Contract NAS3-24105)
(NASA-CR-175098; NAS 1.26:175098; AIAA-86-1520) Avail: NTIS HC A02/MF A01 CSCL 01A

A numerical method is developed to analyze the inviscid flowfield of a high speed inlet by the solution of the Euler equations. The lower-upper implicit scheme in conjunction with adaptive dissipation proves to be an efficient and robust nonoscillatory shock capturing technique for high Mach number flows as well as for transonic flows. Author

N86-23564*# Vanderbilt Univ., Nashville, Tenn. Dept. of Mechanical and Materials Engineering.
COMMENTARY ON THE 1985 NASA/VANDERBILT SYMPOSIUM ON FUTURE HYPERVELOCITY FLIGHT REQUIREMENTS Semiannual Status Report, 1 Sep. 1985 - 28 Feb. 1986
J. Leith Potter 1 Mar. 1986 16 p refs
(Grant NAG1-549)
(NASA-CR-176747; NAS 1.26:176747; SASR-2) Avail: NTIS HC A02/MF A01 CSCL 01A

The discussion, started in Semiannual Status Report Number 1, on aerothermal problems of hypervelocity flight and experiments that may lead to significant improvements in analytical/computational predictive methods, continues. The commentary is based on presentations made by speakers at a symposium on this subject held in December 1985. Symposium participants focused on the serious deficiencies that exist in knowledge of real-gas, nonequilibrium thermochemical-kinetic processes, catalytic processes, surface and shock slip, gas/surface interaction, boundary layer transition, and vortical leeside flows under hypervelocity conditions. Programs of laboratory research and computations leading toward in-flight experiments were recommended. Feasibility of appropriate measurement techniques for the flight environment was assessed and problems for study in that area identified. A synopsis of the oral presentations is given. Author

N86-23565*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
USER'S GUIDE FOR NASCRIN: A VECTORIZED CODE FOR CALCULATING TWO-DIMENSIONAL SUPERSONIC INTERNAL FLOW FIELDS
Ajay Kumar Feb. 1984 70 p
(NASA-TM-85708; L-15678; NAS 1.15:85708) Avail: NTIS HC A04/MF A01 CSCL 01A

A computer program NASCRIN has been developed for analyzing two-dimensional flow fields in high-speed inlets. It solves the two-dimensional Euler or Navier-Stokes equations in conservation form by an explicit, two-step finite-difference method. An explicit-implicit method can also be used at the user's discretion for viscous flow calculations. For turbulent flow, an algebraic, two-layer eddy-viscosity model is used. The code is operational on the CDC CYBER 203 computer system and is highly vectorized to take full advantage of the vector-processing capability of the system. It is highly user oriented and is structured in such a way that for most supersonic flow problems, the user has to make only a few changes. Although the code is primarily written for supersonic internal flow, it can be used with suitable changes in the boundary conditions for a variety of other problems. Author

N86-23566*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
LOCALLY LINEARIZED LONGITUDINAL AND LATERAL-DIRECTIONAL AERODYNAMIC STABILITY AND CONTROL DERIVATIES FOR THE X-29A AIRCRAFT
Gerald D. Budd Jan. 1984 480 p
(NASA-TM-84919; H-1203; NAS 1.26:84919) Avail: NTIS HC A21/MF A01 CSCL 01A

The locally linearized longitudinal and lateral-directional aerodynamic stability and control derivatives for the X-29A aircraft were calculated for altitudes ranging from sea level to 50,000 ft, Mach numbers from 0.2 to 1.5, and angles of attack from -5 deg to 25 deg. Several other parameters were also calculated, including aerodynamic force and moment coefficients, control face position, normal acceleration, static margin, and reference angle of attack. Author

N86-23567*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
GEOMETRIC AND STRUCTURAL PROPERTIES OF A RECTANGULAR SUPERCRITICAL WING OSCILLATED IN PITCH FOR MEASUREMENT OF UNSTEADY TRANSONIC PRESSURE DISTRIBUTIONS
Rodney H. Ricketts, Judith J. Watson, Maynard C. Sandford, and David A. Seidel Nov. 1983 19 p refs
(NASA-TM-85673; NAS 1.15:85673) Avail: NTIS HC A02/MF A01 CSCL 01A

Wind-tunnel tests to measure unsteady aerodynamic data in the transonic region have been completed on an aspect ratio 2.0 rectangular wing with a supercritical airfoil. The geometric and structural properties of the wing are presented. (Other references contain the measured aerodynamic data.) Both measured and design airfoil coordinates are presented and compared. In addition, measured wing bending and torsional stiffness distributions and some trailing-edge flexibility influence coefficients are presented. Author

N86-23568*# Analytical Methods, Inc., Redmond, Wash.
INVESTIGATION TO ADVANCE PREDICTION TECHNIQUES OF THE LOW-SPEED AERODYNAMICS OF V/STOL AIRCRAFT
B. Maskew, D. Strash, J. Nathman, and F. A. Dvorak Feb. 1985 153 p refs
(Contract NAS2-11169)
(NASA-CR-166479; NAS 1.26:166479) Avail: NTIS HC A08/MF A01 CSCL 01A

A computer program, VSAERO, has been applied to a number of V/STOL configurations with a view to advancing prediction techniques for the low-speed aerodynamic characteristics. The program couples a low-order panel method with surface streamline calculation and integral boundary layer procedures. The panel method--which uses piecewise constant source and doublet panels-includes an iterative procedure for wake shape and models boundary layer displacement effect using the source transpiration technique. Certain improvements to a basic vortex tube jet model were installed in the code prior to evaluation. Very promising results were obtained for surface pressures near a jet issuing at 90 deg from a flat plate. A solid core model was used in the initial part of the jet with a simple entrainment model. Preliminary representation of the downstream separation zone significantly improve the correlation. The program accurately predicted the pressure distribution inside the inlet on the Grumman 698-411 design at a range of flight conditions. Furthermore, coupled viscous/potential flow calculations gave very close correlation with experimentally determined operational boundaries dictated by the onset of separation inside the inlet. Experimentally observed degradation of these operational boundaries between nacelle-alone tests and tests on the full configuration were also indicated by the calculation. Application of the program to the General Dynamics STOL fighter design were equally encouraging. Very close agreement was observed between experiment and calculation for the effects of power on pressure distribution, lift and lift curve slope. Author

N86-23569*# Rockwell International Science Center, Thousand Oaks, Calif.
NONLINEAR POTENTIAL ANALYSIS TECHNIQUES FOR SUPERSONIC-HYPERSONIC AERODYNAMIC DESIGN
V. Shankar and W. C. Clever 7 Mar. 1984 57 p refs
(NASA-CR-172299; NAS 1.26:172299) Avail: NTIS HC A04/MF A01 CSCL 01A

Approximate nonlinear inviscid theoretical techniques for predicting aerodynamic characteristics and surface pressures for relatively slender vehicles at supersonic and moderate hypersonic speeds were developed. Emphasis was placed on approaches that would be responsive to conceptual configuration design level of effort. Second order small disturbance and full potential theory was utilized to meet this objective. Numerical codes were developed for relatively general three dimensional geometries to evaluate

the capability of the approximate equations of motion considered. Results from the computations indicate good agreement with experimental results for a variety of wing, body, and wing-body shapes. Author

N86-23570# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.
VALIDATION OF USAF STABILITY AND CONTROL DATCOM METHODOLOGIES FOR STRAIGHT-TAPERED SWEPTFORWARD WINGS Final Report, 1 Nov. 1980 - 30 Apr. 1984
Daniel G. Sharpes Jul. 1985 211 p
(AF Proj. 2403)
(AD-A161876; AFWAL-TR-84-3084) Avail: NTIS HC A10/MF A01 CSCL 20/4

A detailed review of USAF Stability and Control Datcom methodologies was conducted to determine their validity for application to straight tapered, sweptforward wing configurations. To the extent possible the format found in the Datcom is repeated in this report. Several methods were modified to enable more accurate coefficient prediction (e.g., Wing Zero-Lift Angle of Attack, Downwash and Yawing Moment due to Yaw Rate) irrespective of sweep sign. At supersonic speeds, the reversibility theorem enabled most methodologies to be used without any modifications to account for sweptforward leading-edge designs. For the methodologies validated, sweptforward-wing estimation results were generally as accurate as the sweptback-wing results presented in the Datcom. Unfortunately, lack of test data prevented validation of several empirical methodologies (e.g., Subsonic High Angle-of-Attack Pitching Moment and Transonic Pitching Moment). No estimation methodologies are proposed in these cases.
Author (GRA)

N86-23571# Oklahoma Univ., Norman. School of Aerospace Mechanical and Nuclear Engineering.
OPTIMIZATION OF TIP STORE MODELING Final Report, May 1983 - Sep. 1984
Alfred G. Striz and Sun-Kuk Jang Mar. 1985 105 p
(Grant AF-AFOSR-0184-83)
(AD-A162119; AFOSR-85-1089TR) Avail: NTIS HC A06/MF A01 CSCL 20/4

Due to the high cost of performing detailed three-dimensional flutter analyses for aircraft which are carrying large numbers and types of external stores, it is often not economically feasible to include sophisticated store aerodynamics especially when they will not cause significant changes to the flutter results. Thus, the stores are presently often modeled as simple flat plates. This tends to decrease the accuracy of the computed pressure distributions as the spanwise flow field and the wing-body interaction are not represented correctly. In this report, therefore, two methods, a doublet lattice method for subsonic flow and a kernel function method for subsonic and supersonic flow are used for the computation of unsteady pressure distributions and forces on an F-5 wing with a tip mounted launcher/store combination for various store models consisting of simple flat plates, endplated, and axisymmetric bodies. The resulting aerodynamic data are compared to existing experimental and numerical results for the same wing/store combination. The store modeling was optimized for simplicity and accuracy with respect to the aerodynamic forces and pressures. The wing-body interaction was improved without a considerable increase in complexity, i.e., panel number, and thus computational effort. Author (GRA)

N86-23572# Indiana Univ.-Purdue Univ., Indianapolis. School of Engineering and Technology.
A ZONAL APPROACH TO THE DESIGN OF FINITE ELEMENT GRIDS FOR 3-D TRANSONIC FLOWS WITH COMPLEX GEOMETRIES Annual Report, 1 Jun. 1983 - 30 Jun. 1985
Akin Ecer 30 Jun. 1985 98 p
(Contract F49620-83-K-0034)
(AD-A162168; AFOSR-85-1061TR) Avail: NTIS HC A05/MF A01 CSCL 20/4

A block-structured solution scheme is developed for the analysis of three-dimensional transonic flows. The scheme is based on the solution of potential flow equations for individual blocks representing part of the flow field. Based on a previously developed block-structured grid generation scheme, appropriate computational grids are generated for each of the blocks depending on the complexity of the local flow field. The equations are then solved to provide a solution of a large problem in terms of an assembly of smaller problems for each block. Numerical results illustrate the applicability of the method for a three-dimensional flow field around a wing profile (NACA0012). Different block structures are analyzed to demonstrate the robustness and the accuracy of the developed method. Finally a three-dimensional wing-body configuration is analyzed and the results are compared with previously obtained single block solutions. The method is expandable to the solution of Euler and Navier-Stokes equations. It is also suited to be executed in a parallel processing environment. GRA

N86-23573# Boeing Commercial Airplane Co., Seattle, Wash.
COUPLING LINEARIZED FAR-FIELD BOUNDARY CONDITIONS WITH NONLINEAR NEAR-FIELD SOLUTIONS IN TRANSONIC FLOW Annual Report, 1 Jul. 1983 - 1 Feb. 1985
William S. Rowe and F. E. Ehlers 1 Feb. 1985 82 p
(Contract F49620-83-C-0118)
(AD-A162334; D6-52895; AFOSR-85-1082TR) Avail: NTIS HC A05/MF A01 CSCL 20/4

This investigation evaluated the feasibility of coupling linearized far-field finite differencing equations to reduce the size of grid networks required in present transonic flow calculations. A procedural change to an existing finite differencing program involved distributing sources on the solution interface boundary in order to develop the proper far-field outgoing wave boundary condition on a reduced size grid network. Validation of the modification procedure was established for zero thickness airfoils by comparing predicted two-dimensional results with results obtained from an exact procedure. A criterion based on the gradient of the flow field Mach number was developed for use in establishing the minimum size grid network necessary for accurate finite thickness unsteady loading predictions. Acceptable loading predictions were achieved for a nominal 5:1 gridsize reduction ratio with a 40% reduction in computer usage costs. GRA

N86-23574# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ACTA AERODYNAMICA SINICA (SELECTED ARTICLES)
Mingke Huang, Shijun Luo, Huili Shen, Minggang Ji, and Zongwen Xing 22 Nov. 1985 95 p Transl. into ENGLISH from Zhongguo Quiliu Dongli Xue (China), no. 2, 66-72, 78-82, 87-92, 1984 p 19-40
(AD-A162351; FTD-ID(RS)T-0493-85) Avail: NTIS HC A05/MF A01 CSCL 20/4

A Fast Algorithm of the Finite Difference Method for the Computation of the Transonic flow Past an Arbitrary Air foil with the Conservation of the Full Potential Equation; A Mixed Finite Difference Analysis of the Internal and External Transonic Flow Fields of Center Cone Inlet; Numerical Method for Viscous Shock-layer near the Stagnation Line of a Blunt Body; The Perfection and Application of the Flutter Subcritical Response Analysis; Calculation of Octagonal Wall Interference Factor Using Conformal Mapping; and Cryogenic High Reynolds Number Transonic Wind Tunnel with Pre-cooled and Restricted Flow. GRA

N86-23575# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ACTA AERODYNAMICA SINICA (SELECTED ARTICLES)
Fenggan Zhuang, Hanxin Zhang, Guocan Ling, Shauwen Xiung, and Peiye Zhu 5 Dec. 1985 182 p Transl. into ENGLISH from Konggi Donglixue Xuebao (China), no. 4, 1984 p 1-4; 21-33; 41-97
(AD-A162993; FTD-ID(RS)T-0639-85) Avail: NTIS HC A09/MF A01 CSCL 20/4

Titles include: Advances in the Study of Separated Flows; Problems in Discrete Vortex Numerical Modelling of Vortex Motion behind a Circular Cylinder; Calculation of Slender Delta Wing with Leading-edge Separation by Quasi-vortex-lattice Method; Calcula-

tion of Flow around Thick Wing with Separation Vortices; Split Coefficient Matrix Difference Method for Supersonic Three-dimensional Flow; Some Characteristics of the FLIC Method and Its Application to Calculation of Pitot Pressure of Dusty-Gas Shock Tube Flow; Experimental Investigation of Flap Turbulent Heat Transfer and Pressure Characteristics in Hypersonic Flow; Laser Doppler Anemometer Measurements for Leading Edge Vortex Core Velocity of a Strake-wing; Experimental Research of Boundary Layer Control Technique for Low Speed Multi-component Airfoils; A Simpler Implicit Method to Solve N-S Equation; Numerical Calculation of Separation Flow over Severely Indented Blunt Body; Implicit Technique for Calculating Separated Base Flow; Computation of Compressible Turbulent Separated Boundary Layer; Inverse Boundary Layer Method for Separated Flow; Wall Lift Interference Corrections in Ground Effect Testing. (Translations; China; Chinese language) GRA

N86-23576# Technische Hochschule, Darmstadt (West Germany). Fachgebeit Aerodynamik und Messtechnik.
INVESTIGATIONS IN THE FLOW FIELD OF AIRFOILS WITH VARIOUS GEOMETRIES IN THE DOMAIN OF HIGH ANGLES OF ATTACK. EXPERIMENTAL INVESTIGATIONS Final Report [UNTERSUCHUNGEN IM STROEMUNGSFELD VON FLUEGELN VERSCHIEDENER GEOMETRIE IM HOHEN ANSTELLWINKELBEREICH. EXPERIMENTELLE UNTERSUCHUNGEN]
Werner Moeller 2 Sep. 1985 111 p refs In GERMAN
(Contract DFG-Ha-514/63-2)
(Rept-A-13/85) Avail: NTIS HC A06/MF A01

A measuring system to determine flow fields of airfoils was developed. Pressure distribution measurements and pictures were taken to characterize all flight conditions in the domain of high angles of attack where flow separation phenomena are very important. The developed direct flow field measuring system uses hot-wire anemometry and enables the investigation of three-dimensional separation effects on an arrow wing. The results provide important information about the separation behavior of such wings and fundamentals for the development and testing of theoretical methods to calculate separated wing flow.
Author (ESA)

N86-23859# Ochanomizu Women's Univ., Tokyo (Japan).
INTERACTIONS OF VORTICES
Yuko Oshima *In* Tokyo Univ. Proceedings of the Symposium on Mechanics for Space Flight Mar. 1985 p 3-15 refs (For primary document see N86-23858 14-34)
Avail: NTIS HC A08/MF A01

N86-23860# Tokyo Univ. (Japan).
NUMERICAL STUDY OF TWO-DIMENSIONAL VORTEX STREET
Kazuhiro Tsuboi and Koichi Oshima *In its* Proceedings of the Symposium on Mechanics for Space Flight Mar. 1985 p 17-30 refs (For primary document see N86-23858 14-34)
Avail: NTIS HC A08/MF A01

N86-23862# Tokyo Univ. (Japan).
NUMERICAL SIMULATION OF VORTICES SHED BEHIND A ROTATING WING
Naoki Izutsu and Hidesada Kanda (IBM Japan, Ltd.) *In its* Proceedings of the Symposium on Mechanics for Space Flight Mar. 1985 p 43-50 refs Sponsored in part by IBM Japan, Ltd. (For primary document see N86-23858 14-34)
Avail: NTIS HC A08/MF A01

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N86-23577*# Sverdrup Technology, Inc., Cleveland, Ohio.
ANALYTICAL DETERMINATION OF PROPELLER PERFORMANCE DEGRADATION DUE TO ICE ACCRETION Final Report
Thomas L. Miller Apr. 1986 138 p refs
(Contract NAS3-24105)
(NASA-CR-175092; NAS 1.26:175092) Avail: NTIS HC A07/MF A01 CSCL 01C

A computer code has been developed which is capable of computing propeller performance for clean, glaze, or rime iced propeller configurations, thereby providing a mechanism for determining the degree of performance degradation which results from a given icing encounter. The inviscid, incompressible flow field at each specified propeller radial location is first computed using the Theodorsen transformation method of conformal mapping. A droplet trajectory computation then calculates droplet impingement points and airfoil collection efficiency for each radial location, at which point several user-selectable empirical correlations are available for determining the aerodynamic penalities which arise due to the ice accretion. Propeller performance is finally computed using strip analysis for either the clean or iced propeller. In the iced mode, the differential thrust and torque coefficient equations are modified by the drag and lift coefficient increments due to ice to obtain the appropriate iced values. Comparison with available experimental propeller icing data shows good agreement in several cases. The code's capability to properly predict iced thrust coefficient, power coefficient, and propeller efficiency is shown to be dependent on the choice of empirical correlation employed as well as proper specification of radial icing extent.
Author

N86-23578# Luftfahrt-Bundesamt, Brunswick (West Germany). Flugunfalluntersuchungsstelle.
RESULTS OF THE TECHNICAL INVESTIGATION OF ACCIDENTS DURING THE OPERATION OF GERMAN AIRCRAFT AT HOME AND ABROAD, AND OF FOREIGN AIRCRAFT IN GERMANY Annual Report, 1982 [ERGEBNISSE DER FACHLICHEN UNTERSUCHUNG VON UNFAELLEN BEI DEM BETRIEB DEUTSCHER LUFTFAHRZEUGE IM IN- UND AUSLAND SOWIE AUSLAENDISCHE LUFTFAHRZEUGE IM INLAND]
Jul. 1985 119 p In GERMAN
Avail: NTIS HC A06/MF A01

All aircraft accidents since January 1, 1973 were analyzed. Standardized tables giving a general overview are presented. Special statistics can be provided, for which selection criteria and table parameters can be freely chosen. Author (ESA)

N86-23579# Deutsche Lufthansa Aktiengesellschaft, Cologne (West Germany).
[DIGEST OF THE DEUTSCHE LUFTHANSA REPORT, 1984] Annual Report, 1984
1984 22 p
(ISSN-0415-603X) Avail: NTIS HC A02/MF A01

The economic status of the Lufthansa airline for the fiscal year 1984 is summarized. Company policy is outlined.
Author (ESA)

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications.*

N86-23580 Department of the Air Force, Washington, D.C.
GLIDE SLOPE INDICATOR SYSTEM Patent
Ivan S. Wyatt and Harry L. Task, inventors (to Air Force) Issued

19 Nov. 1985 6 p Supersedes AD-D010173
(AD-D012077; US-Patent-4,554,543; US-Patent-Appl-SN-473392; US-Patent-Class-340-948) Avail: US Patent and Trademark Office CSCL 01/5

A glide slope indicator system in which light from an incoming aircraft's landing light is shaped by spherical/cylindrical lens combination into a line image which strikes a linear photodiode array. By determining which photodiode in the array the center of the line image strikes, the glide slope angle can be determined. An appropriate signal is communicated to the pilot via a pair of indicator lights mounted on the runway depending upon whether the aircraft is above, below or on the desired glide slope angle. GRA

N86-23581# IIT Research Inst., Annapolis, Md.
THE IMPACT OF A TRAFFIC ALERT AND COLLISION AVOIDANCE SYSTEM ON THE AIR TRAFFIC CONTROL RADAR BEACON SYSTEM AND THE MODE S SYSTEM IN THE LOS ANGELES BASIN Final Report, 15 Jan. 1981 - 15 Jul. 1984
May 1985 133 p refs Prepared in part for Electromagnetic Compatability Analysis Center, Annapolis, Md.
(Contract F19628-80-C-0042)
(FAA-PM-84-30; ECAC-PR-84-003) Avail: NTIS HC A07/MF A01

An analysis was performed to predict the impact of the Traffic Alert and Collision Avoidance System (TCAS) on the performance of selected air traffic control and surveillance systems in the Los Angeles Basin. The predictions involved the impact of minimum TCAS II (TCAS II M) on both the Air Traffic Control Radar Beacon System (ATCRBS) interrogator at Long Beach, and a hypothetical Mode S sensor at Los Angeles (LAX-4), as well as the impact of the combined TCAS I and TCAS II M signal environment on the Long Beach ATCRBS interrogator. These predictions were made using a hypothetical peak Los Angeles Basin airborne deployment and subsets of that deployment. Author

N86-23582# Lear Siegler, Inc., Grand Rapids, Mich.
PRELIMINARY HAZARD ANALYSIS FOR SELF-CONTAINED NAVIGATION SYSTEM
J. T. Reeves 4 Oct. 1985 18 p
(Contract F09603-85-C-1224)
(AD-A161883; MISC-2037) Avail: NTIS HC A02/MF A01 CSCL 17/7

This document constitutes the Preliminary Hazard Analysis (PHA) for the C-130 Self-Contained Navigation System (SCNS) installation. It provides an initial risk assessment of the SCNS installation. The purpose of the PHA is to identify safety critical areas, evaluate hazards, and identify the safety design criteria to be used. The items covered in this analysis are to be used during the design phase and trade-off study period to prevent unsafe concepts, designs, or oversights that could lead to incorporation of hazards in the hardware, the system operation, handling, and maintenance. The scope of this analysis for Data Item 0103 is limited to the SCNS installation task A-kit components (viz wiring harness, brackets, racks, control panels, relay boxes, circuit breakers), B-kit components (e.g., ICDUs, BICU, DVS, INU), and the physical interfaces with existing equipment (e.g., CADC or Sensors, Radar, Air Data Sensors). These items will be analyzed in respect to safe installation, safe hardware, and safe usuage (e.g., installation, removal, in-place test, and handling). GRA

N86-23583# Air Force Armament Lab., Eglin AFB, Fla.
PROCEEDINGS OF THE 12TH BIENNIAL GUIDANCE TEST SYMPOSIUM HELD AT HOLLOMAN AFB, NEW MEXICO ON 22-24 OCTOBER 1985, VOLUME 1
Kenneth S. Morgan, Patricia Romanowski, L. Vallot, G. Stein, and D. Enns 15 Oct. 1985 252 p Symposium held at Holloman AFB, N. Mex., 22-24 Oct. 1985
(AD-A161996; AD-TR-85-54-Vol-1) Avail: NTIS HC A12/MF A01 CSCL 17/7

These proceedings contain papers which were presented at the Twelfth Biennial Guidance Test Symposium. This symposium, hosted by the Central Inertial Guidance Test Facility, Holloman Air Force Base, New Mexico on 22 to 24 Oct. 1985, was directed toward the exchange of information, stimulation of new ideas, and discussion of current techniques associated with the development and evaluation of inertial guidance and navigation systems. The papers presented included such topics as new test and calibration techniques for accelerometers and ring laser gyros, advances in flight reference systems, new test equipment, and new software developments. Papers presented in the classified portion of the symposium are published as Volume 2. Critical technology papers are published as Volume 3. Author (GRA)

N86-23584# Department of the Navy, Washington, D. C.
AN APPARATUS FOR AND A METHOD OF DETERMINING COMPASS HEADINGS Patent Application
Daniel G. Jablonski, inventor (to Navy) Filed 24 Jun. 1985 12 p
(AD-D012051; US-Patent-Appl-SN-748248) Avail: NTIS HC A02/MF A01 CSCL 17/3

A compass system and method incorporating a global positioning system (GPS), such as the NAVSTAR/GPS multisatellite system, is configured to acquire accurate compass heading information without being affected by magnetic anomalies and without being dependent on the elapsed time since a previous position fix. The compass system comprises, inter alia, two antenna/preamplifiers located, for example, fore and aft a ship or aircraft separated by a predetermined distance d. A microprocessor/minicomputer portion of the system causes an electronic coaxial switch to switch a GPS receiver between the two antenna/preamplifiers automatically thereby measuring their absolute positions. The microprocessor/minicomputer computes and displays on a display unit a compass heading based on the knowledge of the absolute positions of the antenna/preamplifiers and the distance d there between. GRA

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.*

N86-23585 Fraunhofer-Inst. fuer Betriebsfestigkeit, Darmstadt (West Germany).
STANDARDIZED FATIGUE LOADING SEQUENCES FOR HELICOPTER ROTORS (HELIX AND FELIX). PART 1: BACKGROUND AND FATIGUE EVALUATION. PART 2: FINAL DEFINITION OF HELIX AND FELIX
D. Schuetz, H.-G. Koebler, W. Schuetz (Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn, West Germany), M. Hueck (Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn, West Germany), J. B. deJonge (NLR, Emmeloord, Netherlands), A. A. tenHave (NLR, Emmeloord, Netherlands), F. Och (Messerschmitt-Boelkow-Blohm G.m.b.H., Munich, West Germany), G. Daske (Messerschmitt-Boelkow-Blohm G.m.b.H., Munich, West Germany), P. R. Edwards, comp. (RAE, Farnborough, England), J. Darts, comp. (RAE, Farnborough, England) et al 1985 235 p refs Sponsored by Bundesministerium fuer Forschung und Technologie
(LBF-FB-167; IABG-TF-1425/1; IABG-TF-1425/2; NLR-TR-84043-U-Pt-1; NLR-TR-84043-U-Pt-2; RAE-TR-84084; RAE-TR-84085; ISSN-0721-5320) Copyright. Avail: Issuing Activity

The Helix and Felix standard loading sequences for the main rotors of helicopters with articulated and semirigid rotors respectively are described. The definition of Helix and Felix, statistical content according to different counting methods, and the results of fatigue tests used to assess them are outlined. The defined form of the two standards is given in full length and shortened versions. The method of generation is extremely simple, although a considerable amount of data is required for the generation algorithm. A FORTRAN program for this purpose, together with complete data tables in the correct format, are presented. Author (ESA)

N86-23586*# Lightning Technologies, Inc., Pittsfield, Mass.
LIGHTNING PROTECTION GUIDELINES AND TEST DATA FOR ADHESIVELY BONDED AIRCRAFT STRUCTURES Final Report
J. E. Pryzby and J. A. Plumer Washington NASA Jan. 1984 175 p refs
(Contract NAS1-15884)
(NASA-CR-3762; NAS 1.26:3762; LT-83-155) Avail: NTIS HC A08/MF A01 CSCL 01C

The highly competitive marketplace and increasing cost of energy has motivated manufacturers of general aviation aircraft to utilize composite materials and metal-to-metal bonding in place of conventional fasteners and rivets to reduce weight, obtain smoother outside surfaces and reduce drag. The purpose of this program is protection of these new structures from hazardous lightning effects. The program began with a survey of advance-technology materials and fabrication methods under consideration for future designs. Sub-element specimens were subjected to simulated lightning voltages and currents. Measurements of bond line voltages, electrical sparking, and mechanical strength degradation were made to comprise a data base of electrical properties for new technology materials and basic structural configurations. The second hase of the program involved tests on full scale wing structures which contained integral fuel tanks and which were representative of examples of new technology structures and fuel systems. The purpose of these tests was to provide a comparison between full scale structural measurements and those obtained from the sub-element specimens. Author

N86-23587*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
MINIMUM TIME AND FUEL FLIGHT PROFILES FOR AN F-15 AIRPLANE WITH A HIGHLY INTEGRATED DIGITAL ELECTRONIC CONTROL (HIDEC) SYSTEM
Edward A. Haering, Jr. and Frank W. Burcham, Jr. Jun. 1984 25 p refs
(NASA-TM-86042; H-1242; NAS 1.15:86042) Avail: NTIS HC A02/MF A01 CSCL 01C

A simulation study was conducted to optimize minimum time and fuel consumption paths for an F-15 airplane powered by two F100 Engine Model Derivative (EMD) engines. The benefits of using variable stall margin (uptrim) to increase performance were also determined. This study supports the NASA Highly Integrated Digital Electronic Control (HIDEC) program. The basis for this comparison was minimum time and fuel used to reach Mach 2 at 13,716 m (45,000 ft) from the initial conditions of Mach 0.15 at 1524 m (5000 ft). Results were also compared to a pilot's estimated minimum time and fuel trajectory determined from the F-15 flight manual and previous experience. The minimum time trajectory took 15 percent less time than the pilot's estimate for the standard EMD engines, while the minimum fuel trajectory used 1 percent less fuel than the pilot's estimate for the minimum fuel trajectory. The F-15 airplane with EMD engines and uptrim, was 23 percent faster than the pilot's estimate. The minimum fuel used was 5 percent less than the estimate. Author

N86-23588*# Computer Sciences Corp., Hampton, Va.
IMPROVEMENTS TO THE FATOLA COMPUTER PROGRAM INCLUDING ADDED ACTIVELY CONTROLLED LANDING GEAR SUBROUTINES Final Report
G. H. Mall Apr. 1983 217 p
(Contract NAS1-16078)
(NASA-CR-166069; NAS 1.26:166069; TAO-33842) Avail: NTIS HC A10/MF A01 CSCL 01C

Modifications to a multi-degree-of-freedom flexible aircraft take-off and landing analysis (FATOLA) computer program, including a provision for actively controlled landing gears to expand the programs simulation capabilities, are presented. Supplemental instructions for preparation of data and for use of the modified program are included. Author

N86-23589# Hover Systems Federal Corp., Eddystone, Pa.
AFTER ACTION REPORT, CH-47 RECOVERY USING D-PAAC Report, 13 - 21 Jul. 1985
Jul. 1985 29 p
(Contract DAAK70-85-C-0014)
(AD-A161935) Avail: NTIS HC A03/MF A01 CSCL 13/2

On 12 July 1985, a request was made for use of the D-PAAC in a recovery operation for a crashed CH-47D, which had crashed in a fish and wildlife management area on the New Jersey shore near the Delaware river. Recovery operations were to be conducted with minimal damage to the environment and as quickly as possible. This report will cover the period from 13 to 21 July and will address the period in three sections. The first will cover preparation and movement from Duck, N.C., to Chester, Pa. The second will cover preparation at Chester, Pa., and movement to the crash site. The third will cover operations at the crash site and movement out of the area. The D-PAAC operated on cushions at all times. the concept of using air cushion craft for heavy lift recovery operations in terrain which offers no other accessibility was partially validated. Also, the feasibility of towing an air cushion vehicle over water by conventional tug in an inland waterway operation was proven. It must also be concluded that improved propulsion means are required as well as some self-recovery capability (on-board winch) to improve useability of future craft similiar to the D-PAAC. GRA

N86-23590# Naval Research Lab., Washington, D. C.
ELECTROSTATIC CHARGING OF THE CH-53E HELICOPTER
R. E. Pechacek, J. R. Greig, D. P. Murphy, and J. Spelz 29 Nov. 1985 48 p
(F41-411)
(AD-A161936; NRLMR-5676) Avail: NTIS HC A03/MF A01 CSCL 01/3

The effects of electrostatic charging on the CH-53E helicopter were examined. Measurements were made over a clean runway and over sandy terrain in basically desert conditions where electrostatic charging is known to be a problem. While the measured charging current (up to approx. 75 microAmp) and open circuit voltages (up to approx. 140 kV) cannot be claimed as maximum values attainable by the CH-53E, they show that the CH-53E is affected by electrostatic charging in much the same way as all other helicopters. Furthermore the range of data recorded in these tests has allowed us to formulate a model for the electrostatic charging of a hovering helicopter in both clean air and sandy air situations. This model is consistent with our own data and recorded prior experience with electrostatic charging of helicopters. It predicts that the CH-53E can readily attain short circuit currents of approx. 300 microAmp and open circuit voltages of approx. 400 kV. GRA

N86-23591# Army Science Board, Washington, D.C.
THE US ARMY'S LHX (LIGHT HELICOPTER FAMILY) PROGRAM Final Report, 1983 - 1984
Wesley L. Harris, John Blair, Gilbert F. Decker, and Robert L. McDaniel Dec. 1984 50 p
(AD-A161949) Avail: NTIS HC A03/MF A01 CSCL 01/3

Observations, analysis, conclusions and recommendations of the AHSG on selected critical issues related to the Army's LHX aircraft program are described. The basis of LHX, LHX program management, technology risk assessment, speed, and one versus two-man flight crew are discussed in the initial sections of this report. These issues constitute the more fundamental aspects of the Army's LHX program which were reviewed by the AHSG. Primary and secondary conclusions and recommendations are presented. Finally, a discussion of specific technologies and Army aviation programs is given in the appendices to this report. The discussion of each of these technologies and programs includes the AHSG's recommendations and conclusions on the same. A set of attachments follows the appendices. GRA

N86-23592# Drexel Univ., Philadelphia, Pa. Dept. of Materials Engineering.
A FUNDAMENTAL STUDY OF DROPLET IMPINGEMENT, SPREADING AND CONSOLIDATION Annual Report, 1 Jul. 1984 - 30 Jun. 1985
D. Apelian, A. Lawley, G. Gillen, and P. Mathur 1 Sep. 1985

32 p
(Contract N00014-84-K-0472)
(AD-A162035; TR-1) Avail: NTIS HC A03/MF A01 CSCL 07/1

Spray forming in the Osprey mode is a process in which gas atomized molten metal droplets are interrupted in flight by impingement on a substrate to form a relatively thick deposit. The overall objective of this research program is to develop a fundamental processing science base for the process. To this end, concurrent experimental and modeling studies focus on droplet velocity and temperature profiles, the mechanism(s) of droplet-substrate interactions, droplet spreading on impact and droplet solidification, and the relationship between process parameters and microstructural integrity of the deposit. On-going experimental studies are reviewed and some preliminary results of the modeling work are presented. GRA

N86-23593# Naval Postgraduate School, Monterey, Calif.
A SYSTEMS ENGINEERING METHODOLOGY FOR THE ADVANCED TACTICAL AIRCRAFT M.S. Thesis
Stephen J. Kapurch Sep. 1985 89 p
(AD-A162049) Avail: NTIS HC A05/MF A01 CSCL 05/1

The increasing specialization of the aerospace industry coupled with the technical complexity of new systems has caused emphasis to be placed on a systematic and logical methodology to design, develop, and produce new products. A systems engineering model to integrate functional management areas with organizational activities in the Advanced Tactical Aircraft program is presented. Special emphasis is placed in applying this systems approach throughout the life cycle of a project. A general methodology and a synopsis of principles are provided which might be utilized in the development of a systems engineering program. GRA

N86-23594# Sikorsky Aircraft, Stratford, Conn. Sikorsky Aircraft Div.
ADVANCED TECHNOLOGY HELICOPTER LANDING GEAR PRELIMINARY DESIGN INVESTIGATION Final Report, 1983 - 1984
D. Lowry Oct. 1985 135 p
(Contract DAAK51-83-C-0040; DA Proj. 1L1-62209-AH-76)
(AD-A162097; SER-510148; USAAVSCOM-TR-85-D-4) Avail: NTIS HC A07/MF A01 CSCL 01/3

A preliminary design investigation has been performed to develop weight and cost sensitivities of various landing gear systems for a 10,000-pound class LHX helicopter. Weights are established for three baseline main landing gear systems: a noncrashworthy retractable, a crashworthy retractable, and a crashworthy fixed. Each system is capable of kneeling the LHX helicopter. Weights are based on preliminary structural analysis of landing gear loads developed by a computer program KRASH. KRASH was used to obtain the design loads at various sink rates, and pitch and roll attitudes. The design loads were used to size the landing gear structure in order to develop the landing gear weight for the different impact conditions. Main landing gear system costs are developed from the weight data established. An aerodynamic drag assessment was performed. Criteria for crashworthy designs are recommended. The recommended criteria were developed from the weight trends, costs, and UH-60A Class A Mishaps. GRA

N86-23595# Sverdrup Technology, Inc., Arnold Air Force Station, Tenn.
ANALYSIS AND VERIFICATION OF THE ICING SCALING EQUATIONS. VOLUME 1 Final Report, 1 Aug. 1981 - 31 Mar. 1984
Gary A. Ruff Nov. 1985 80 p Sponsored by Air Force
(AD-A162226; AEDC-TR-85-30-Vol-1) Avail: NTIS HC A05/MF A01 CSCL 17/2

The formation of ice on aircraft surfaces occurs during flight through supercooled droplets. Ice accretions on these surfaces usually degrade both aircraft performance and operational safety. For this reason, it has become important in the design and certification phases of system development to evaluate system performance degradation because of icing. A research program was conducted to evaluate the icing scaling requirements. The objectives of the study were (1) to evaluate the equations governing the icing process to identify proposed scaling parameters, (2) to develop a computer code to solve the various forms of the icing scaling equations, (3) to conduct tests to determine which, if any, of the proposed methods produced scale ice accretions, and (4) if an accurate set of icing scaling equations were found, to write a final computer code that could be used in icing tests. The scaling verification tests were conducted using full and half-scale circular cylinders and full, 1/3, and 1/6-scale airfoil sections. GRA

N86-23774# Joint Publications Research Service, Arlington, Va.
ROLLOUT OF XT-4 INTERMEDIATE CLASS TRAINING AIRCRAFT
In its Japan Report: Science and Technology (JPRS-JST-86-007) 25 Mar. 1986 p 1-5 Transl. into ENGLISH from Aerospace Japan (Tokyo, Japan), Jun. 1985 p 31-33 (For primary document see N86-23773 14-31)
Avail: NTIS HC A04/MF A01

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography.*

N86-23596# Air Force Human Resources Lab., Brooks AFB, Tex.
LOGISTICS ENGINEERING ANALYSIS TECHNIQUES FOR FAULT-TOLERANT AVIONICS SYSTEMS Final Report, Mar. 1982 - Mar. 1984
James C. McManus Nov. 1985 59 p
(Contract F33615-82-C-0002)
(AD-A161981; AFHRL-TR-84-60) Avail: NTIS HC A04/MF A01 CSCL 01/4

A technique which performs reliability, supportability, and survivability (RSS) analysis of fault-tolerant, dynamically reconfigurable systems during early design is presented. Implemented in the MIssion REliability Model (MIREM) computer program, this method analyzes the structure of functional components in a system. Use of MIREM will allow design engineers to apply RSS analysis before the design is fixed. GRA

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N86-23597*# California Univ., Irvine. Dept. of Mechanical Engineering.
EFFECT OF LIQUID DROPLETS ON TURBULENCE IN A ROUND GASEOUS JET Final Report
A. A. Mostafa and S. E. Elghobashi Feb. 1986 209 p refs
(Grant NAG3-176)
(NASA-CR-175063; NAS 1.26:175063) Avail: NTIS HC A10/MF A01 CSCL 21E

The main objective of this investigation is to develop a two-equation turbulence model for dilute vaporizing sprays or in general for dispersed two-phase flows including the effects of phase changes. The model that accounts for the interaction between the two phases is based on rigorously derived equations for turbulence kinetic energy (K) and its dissipation rate epsilon of the carrier phase using the momentum equation of that phase. Closure is achieved by modeling the turbulent correlations, up to

third order, in the equations of the mean motion, concentration of the vapor in the carrier phase, and the kinetic energy of turbulence and its dissipation rate for the carrier phase. The governing equations are presented in both the exact and the modeled formes. The governing equations are solved numerically using a finite-difference procedure to test the presented model for the flow of a turbulent axisymmetric gaseous jet laden with either evaporating liquid droplets or solid particles. The predictions include the distribution of the mean velocity, volume fractions of the different phases, concentration of the evaporated material in the carrier phase, turbulence intensity and shear stress of the carrier phase, droplet diameter distribution, and the jet spreading rate. The predictions are in good agreement with the experimental data.
Author

N86-23598*# Garrett Turbine Engine Co., Phoenix, Ariz.
LOW-COST SINGLE-CRYSTAL TURBINE BLADES, VOLUME 2
T. E. Strangman, R. E. Dennis, and B. R. Heath Apr. 1984 42 p refs
(Contract NAS3-20073)
(NASA-CR-174652; NAS 1.26:174652; G-21-4314-2) Avail: NTIS HC A03/MF A01 CSCL 21E

The overall objectives of Project 3 were to develop the exothermic casting process to produce uncooled single-crystal (SC) HP turbine blades in MAR-M 247 and higher strength derivative alloys and to validate the materials process and components through extensive mechanical property testing, rig testing, and 200 hours of endurance engine testing. These Program objectives were achieved. The exothermic casting process was successfully developed into a low-cost nonproperietary method for producing single-crystal castings. Single-crystal MAR-M 247 and two derivatives DS alloys developed during this project, NASAIR 100 and SC Alloy 3, were fully characterized through mechanical property testing. SC MAR-M 247 shows no significant improvement in strength over directionally solidified (DS) MAR-M 247, but the derivative alloys, NASAIR 100 and Alloy 3, show significant tensile and fatigue improvements. Firtree testing, holography, and strain-gauge rig testing were used to determine the effects of the anisotropic characteristics of single-crystal materials. No undesirable characteristics were found. In general, the single-crystal material behaved similarly to DS MAR-M 247. Two complete engine sets of SC HP turbine blades were cast using the exothermic casting process and fully machined. These blades were successfully engine-tested.
Author

N86-23599# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.
THROTTLE DEPENDENT FORCES: A PRIMER Final Report, Aug. 1982 - Nov. 1984
Douglas L. Bowers Nov. 1985 129 p
(AD-A162939; AFWAL-TR-85-3055) Avail: NTIS HC A07/MF A01 CSCL 21/5

An introduction to the broad area of throttle dependent forces for airbreathing aircraft, primarily subsonic to supersonic capable is provided. Basic concepts and examples are presented for subsonic, supersonic and transonic inlet and nozzle applications. Experimental and analytical determination of throttle-dependent forces is discussed, including approaches and potential problems. A final reference section of basic definitions is included for completeness.
GRA

N86-23600# Ohio State Univ., Columbus.
FLOW TRANSITION IN GAS TURBINE AIRFOIL BOUNDARY LAYERS: FUNDAMENTALS AND EMPIRICISMS Final Report, 29 Mar. 1982 - 28 Dec. 1984
Gregory S. West and Lit S. Han Sep. 1985 169 p
(Contracts F33615-82-K-2218; MIPR-C-79073-D)
(AD-A162994; AFWAL-TR-85-2055) Avail: NTIS HC A08/MF A01 CSCL 20/4

Reshotko has suggested that transition may be viewed as the response of a very complex three-dimensional nonlinear oscillator (the laminar boundary layer) to a random and often statistically nonuniform forcing function (the disturbances). The first objective of this study concerns the phenomenon of flow transition in boundary layers on turbine airfoils--from the onset of turbulence to the transition completion. Transition studies, though fundamental to fluid mechanics, are unique in gas turbine cascades because of the compounding factors that act not in individual isolation, but as a collective group and that constitute by-pass mechanisms not amenable to linear analyses from a mathematical point of view. The second objective is to evolve an engineering method to account for surface roughness effects on heat transfer and turbulent boundary layer analyses, which have heretofore been studied in fragments. Transition prediction in gas turbine boundary layer flows is critical in assessing the cooling requirements for gas turbine vanes and blades. This report summarizes the classical, fundamental findings in transition prediction for simplified geometrics and discusses empirical rules curently in use for gas turbine environments.
GRA

N86-23601# Pratt and Whitney Aircraft, West Palm Beach, Fla. Engineering Div.
FRACTURE MECHANICS OF MULTIPLE CRACK INITIATIONS. AN APPLICATION FOR FRACTURE MECHANICS ANALYSIS OF GAS TURBINE ENGINE DISKS Interim Report, Feb. 1981 - Jun. 1983
B. A. Cowles, A. B. Thakker, and G. E. King Oct. 1985 44 p
(Contract F33615-80-C-5160; DARPA Order 3993)
(AD-A162998; PW/ED/FR-18778; AFWAL-TR-85-4110) Avail: NTIS HC A03/MF A01 CSCL 21/5

The purpose of this task was to investigate the current life prediction methodology for multiple crack growth in gas turbine engine components. To this end, experimental and analytical efforts were carried out. Current prediction methods for very small cracks (as small as 0.005 x 0.010 inches) were modified to address the larger interacting cracks produced by the controlled preflaw methods used in this program. The authors conclude that: (1) The modified crack growth life prediction technique currently in use resulted in acceptable but conservative predictions in all cases. Variability in the predictions was also acceptable and was similar to variability in predicted versus actual results for singular crack cases. (2) The multiple-degree-of-freedom approach also produced acceptable life predictions and, in fact, demonstrated reduced variability in predicted versus actual results. It was, however, more complicated to use and did not result in a consistent conservative bias in the life predictions. (3) Based on this study, the modified crack growth life prediction technique currently in use is considered adequate for Retirement-for-Cause applications. The multiple-degree-of-freedom approach offers potential improvements for future use.
GRA

N86-23602# Department of the Navy, Washington, D. C.
IMPROVED PSEUDORANDOM NOISE GENERATOR Patent Application
James R. Young, inventor (to Navy) Filed 17 Jun. 1985 9 p
(AD-D012066; US-Patent-Appl-SN-745155) Avail: NTIS HC A02/MF A01 CSCL 21/5

A circuit for generating a noise signal for use in a jet engine noise simulator which utilizes two component pseudorandom noise (PSN) generators and a combination field effect transistor (FET) and resistor circuit to which the outputs of the PSN generators are connected such that the signal from one PSN generator is modulated by the signal from the other PSN generator.
GRA

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N86-23603*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
DEVELOPMENT EXPERIENCE WITH A SIMPLE EXPERT SYSTEM DEMONSTRATOR FOR PILOT EMERGENCY PRO-

CEDURES
Michael VanNorman and Dale A. Mackall Feb. 1986 17 p refs (NASA-TM-85919; H-1272; NAS 1.15:85919) Avail: NTIS HC A02/MF A01 CSCL 01C

Expert system techniques, a major application area of artificial intelligence (AI), are examined in the development of pilot associate to handle aircraft emergency procedures. The term pilot associate is used to describe research involving expert systems that can assist the pilot in the cockpit. The development of expert systems for the electrical system and flight control system emergency procedures are discussed. A simple, high-level expert system provides the means to choose which knowledge domain is needed. The expert systems were developed on a low-cost, FORTH-based package, using a personal computer. Author

N86-23604*# Tennessee Univ., Tullahoma. Atmospheric Science Div.
ANALYSIS OF DATA FROM NASA B-57B GUST GRADIENT PROGRAM Final Report
Walter Frost, Ming-Chang Lin, Ho-Pen Chang, and Erik Ringnes Sep. 1985 500 p refs
(Contracts NAS8-36177; NAS8-35347)
(NASA-CR-178736; NAS 1.26:178736) Avail: NTIS HC A21/MF A01 CSCL 01C

Statistical analysis of the turbulence measured in flight 6 of the NASA B-57B over Denver, Colorado, from July 7 to July 23, 1982 included the calculations of average turbulence parameters, integral length scales, probability density functions, single point autocorrelation coefficients, two point autocorrelation coefficients, normalized autospectra, normalized two point autospectra, and two point cross sectra for gust velocities. The single point autocorrelation coefficients were compared with the theoretical model developed by von Karman. Theoretical analyses were developed which address the effects spanwise gust distributions, using two point spatial turbulence correlations. B.G.

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N86-23605 Department of the Air Force, Washington, D.C.
DIFFUSE INCANDESCENT RUNWAY MARKER LIGHT APPARATUS FOR OVERT/COVERT OPERATION Patent
Harry L. Task, inventor (to Air Force) Issued 19 Nov. 1985 4 p Supersedes AD-D010634
(AD-D012067; US-Patent-4,554,544; US-Patent-Appl-SN-536142; US-Patent-Class-340-953) Avail: US Patent and Trademark Office CSCL 01/5

A diffuse incandescent runway marker light apparatus has a housing with a visible light diffusing plate mounted in one end and an infrared light diffusing plate mounted in the other end, and a pair of incandescent light sources mounted n the housing and aimed toward the respective housing end plates. A switch, when flipped to a first position, turns on one light source for producing visible illumination and turns off the other light source. The switch, when flipped to a second position, turns off the one light source and turns on the other light source for producing infrared illumination for marking the runway for overt or covert landing operation may be selected. When the switch is flipped to a third poision, both light sources are turned off. GRA

N86-23606*# College of William and Mary, Williamsburg, Va.
COMPUTER SIMULATION OF A WIND TUNNEL TEST SECTION WITH DISCRETE FINITE-LENGTH WALL SLOTS Final Report
William B. Kemp, Jr. Washington NASA Apr. 1986 98 p refs (Contract NCC1-69)
(NASA-CR-3948; NAS 1.26:3948) Avail: NTIS HC A05/MF A01 CSCL 14B

A computer simulation of a slotted wind tunnel test section which includes a discrete, finite-length wall slot representation with plenum chamber constraints and accounts for the nonlinear effects of the dynamic pressure of the slot outflow jet and of the low energy of slot inflow air was developed. The simulation features were selected to be those appropriate for the intended subsequent use of the simulation in a wall interference assessment procedure using sparsely located wall pressure measurements. It is demonstrated that accounting for slot discreteness is important in interpreting wall pressure measured between slots, and that accounting for nonlinear slot flow effects produces significant changes in tunnel-induced velocity distributions and, in particular, produces a longitudinal component of tunnel-induced velocity due to model lift. A characteristic mode of tunnel flow interaction with constraints imposed by the plenum chamber and diffuser entrance is apparent in simulation results and is derived analytically through a simplified analysis. E.A.K.

N86-23607# New Mexico Univ., Albuquerque. Engineering Research Inst.
RUNWAY RUBBER REMOVAL SPECIFICATION DEVELOPMENT: FIELD EVALUATION RESULTS AND DATA ANALYSIS Interim Report, Jul. 1984 - Jul. 1985
Richard A. Graul and Lary R. Lenke Jul. 1985 108 p refs
(Contract F29601-84-C-0080)
(FAA/PM-85/32; ESL-TR-85-63; NMERI-WA5-6(5.04)) Avail: NTIS HC A06/MF A01

The phenomenon of runway touchdown zone rubber buildup which is a potentially hazardous problem is discussed. The use of pavement surface texture measurements is capable of determining pavement friction levels. The use of four economical texture measurement techniques and their relationship to friction levels as determined by the Mu-Meter are discussed. Good correlations are obtained by relating pavement surface texture measurements of friction. However, predictive errors preclude the use of these models in lieu of friction measurements for use in rubber removal guidelines. E.A.K.

N86-23608# National Aeronautical Establishment, Ottawa (Ontario).
RECENT IMPROVEMENTS TO THE NAE 5 FT. x 5 FT. BLOWDOWN WIND TUNNEL
L. H. Ohman, D. Brown, A. J. Bowker, and F. A. Ellis Aug. 1985 41 p
(AD-A162034; NAE-AN-31; NRC-24882) Avail: NTIS HC A03/MF A01 CSCL 14/2

Although the National Aeronautical Establishment (NAE) 5 ft x 5 ft Blowdown Wind Tunnel was conceived in the 1950's, with commissioning in 1962/63, it has stood the test of time very well and is still, in 1985, in heavy demand. Three main reasons for this situation are: (1) the basic wind tunnel design was fundamentally very sound; (2) the wind tunnel circuit and its auxiliary systems have frequently been improved and modernized so that it, even today, is a modern up-to-date facility; and (3) the high level of competence of the supporting staff. This report presents the major improvements made in recent years and the impact these have had on the performance of the facility. The improvements are: the rebuild of the settling chamber; the rebuild of the exhaust diffuser; the installation of active Mach number control for subsonic transonic operation; The incorporation of dual drive on the two-dimensional insert balance system; the suppression of edgetone noise; The incorporation of highly accurate digital pressure transducers; and the control and data processing system. Future plans for expanded use of the wind tunnel are outlined. GRA

N86-23609# General Accounting Office, Washington, D. C. Resources Community and Economic Development Div.
INFORMATION ON AIRPORT AND AIRWAY TRUST FUND REVENUES AND OUTLAYS BY STATES AND LARGE AIRPORTS

30 Sep. 1985 38 p
(PB86-129665; GAO/RCED-85-153; B-219969) Avail: NTIS HC A03/MF A01 CSCL 01A

The Airport and Airway Trust Fund was established to ensure that taxes collected from commercial air passengers, private pilots, and other sources are expended only for the expansion, improvement, and maintenance of the nation's air transportation system. Estimates by states and large airports of taxes paid into the trust fund are presented. Selected trust fund moneys received in fiscal years 1979 to 1983 are estimated. GAO's ability to fully estimate trust fund revenues and outlays by states and large airports was restricted by data limitations that required GAO to make several broad assumptions. The GAO notes that by law, the primary purpose of the trust fund is to ensure the safe operation of this nation's airspace system, not to provide an even or equitable return of the tax revenues to airports and states. Author

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N86-23610# General Technology Systems Ltd., London (England).
NOTES FOR PHILIP LAPP ASSOCIATES CANADA ON THE FUTURE SPACE PROGRAMMES OF GERMANY, SWEDEN, ITALY, FRANCE AND INDIA IN SELECTED AREAS OF ACTIVITY
H. G. R. Robinson, comp. Jun. 1985 39 p
(GTS-85067) Avail: NTIS HC A03/MF A01

Science, materials processing, microgravity, remote sensing, and technology development aspects of the German, French, Italian, Swedish, and Indian space programs are summarized. Participation in ESA and NASA programs, and other forms of international cooperation are discussed. Author (ESA)

N86-23611*# Martin Marietta Aerospace, Denver, Colo.
SERVICERS SYSTEM DEMONSTRATION PLAN AND CAPABILITY DEVELOPMENT Final Technical Report
M. A. Bulboaca, J. A. Cuseo, W. L. DeRocher, Jr., R. W. Maples, P. C. Reynolds, and R. A. Sterrett Dec. 1985 496 p
(Contract NAS8-35625)
(NASA-CR-178714; NAS 1.26:178714; MCR-85-1365; DPD-650; DR-5) Avail: NTIS HC A21/MF A01 CSCL 22A

A plan for the demonstration of the exchange of Multi-Mission Modular Spacecraft (MMS) modules using the servicer mechanism Engineering Test Unit (ETU) was prepared and executed. The plan included: establishment of requirements, conceptual design, selection of MMS spacecraft mockup configuration, selection of MMS module mockup configuration, evaluation of adequacy of ETU load capability, and selection of a stowage rack arrangement. The MMS module exchange demonstration mockup equipment was designed, fabricated, checked out, shipped, installed, and demonstrated. Author

N86-23612*# National Aeronautics and Space Administration, Washington, D.C.
SUMMARY RESULTS OF THE INDUSTRY CONFERENCE ON THE COMMERCIAL USE OF SPACE
Reuse and R. P. Thuerbach Nov. 1985 29 p Transl. into ENGLISH of "Zusammengefasste Ergebnisse aus dem Industriegespraech ueber die Kommerzielle Nutzung der Raumfahrt" rept. Federal Ministry for Research and Technology, Bonn, West Germany, 25 Jun. 1985 p 1-29 Transl. by The Corporate Word, Pittsburgh, Pa.
(Contract NASw-4006)
(NASA-TM-77679; NAS 1.15:77679) Avail: NTIS HC A03/MF A01 CSCL 22A

The future intentions of the Federal Republic of Germany in the area of the commercialization of space are presented. It is shown that significant advances in microgravity research, particularly in the areas of materials science, composite materials, physical chemistry, crystal growth, biology, and process engineering will have an effect on future plans for establishing sponsoring organizations to guide commercial interests in German space research. An organizational and functional outline of a proposed sponsoring organization to promote space commercialization under German supervision, including the objectives, the target group to be served, and the administrative structure, is presented. The role of the DFVLR (German Aerospace Research Establishment) and the BMFT (German Ministry for Research and Technology) as sponsoring organizations representing the interests of the German government is shown. Author

N86-23613# Technische Univ., Berlin (West Germany). Inst. fuer Luft- und Raumfahrt.
EVOLUTION AND LOGISTICS OF AN EARLY LUNAR BASE
B. Johenning and H. H. Koelle 1985 17 p refs
(ILR-Mitt-155) Avail: NTIS HC A02/MF A01

Mission, base, and logistics models were used to assess the feasibility of a lunar base. It is shown that a heavy lift launch vehicle (HLLV) using the present space shuttle main engine can serve as the backbone of such a lunar logistics system. A typical launch schedule reaching 24 flights in its 7th operational year is developed. This HLLV can carry 300 metric tons to the 530km space station orbit or 70 metric tons directly to the lunar surface. The lunar base model suggests landing the first 20 people on the Moon in 1999 and reaches a level of 120 people on the lunar base, plus 20 people in lunar orbit in its 8th year of operation. The lunar base facilities have a total mass of 4000 metric tons in its 10th year. Author (ESA)

N86-23614# Bundesministerium fuer Forschung und Technologie, Bonn (West Germany). Space Technology Section.
LABORATORIES IN SPACE FOR MATERIALS RESEARCH, PROCESS TECHNOLOGY, AND FOR COMMERCIAL PURPOSES
G. Greger, ed. and G. Blechert, ed. 1985 18 p
(ISBN-3-88-135-127-2) Avail: NTIS HC A02/MF A01

The objectives and implementation of the West German space program to study reduced gravity and weightlessness effects are outlined. Objectives include the improvement of physical, chemical, biological, and technical processes, and development of processes which can only function in zero gravity. Implementation measures include Spacelab and sounding rocket flight. Author (ESA)

N86-24509*# Alabama Univ., Birmingham.
CONTAINERLESS PROCESSING OF HYPERMONOTECTIC AND GLASS FORMING ALLOYS USING THE MARSHALL SPACE FLIGHT CENTER 100 METER DROP TUBE FACILITY
J. Barry Andrews *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 25 p refs (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 22A

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

No abstracts in this category.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air).*

N86-23615# Range Commanders Council, White Sands Missile Range, N. Mex. Data Reduction and Computing Group.
DIRECTORY OF RANGE DATA CONVERSION AND PROCESSING SYSTEMS
Sep. 1985 548 p
(AD-A162844; DR/CG-157-84) Avail: NTIS HC A23/MF A01 CSCL 09/2

The members and associate members of the Data Reduction and Computing Group (DR/CG) of the Range Commanders Council (RCC) have exchanged information on the hardware and software systems in use at their respective ranges and agencies at regular intervals with great success. Since other range representatives found this information to be valuable, the group published a Directory of Data Conversion and Processing Systems, RCC Document 127-73, in 1973. This third edition, 157-84, also contains nine chapters, with information updated since the 1980 edition. The directory covers the following topics: Range data conversion, processing systems, pre/post flight computer systems, real-time computer systems, film readers, frequency and wave analysis system, data transmission system, printers and plotters, range instrumentation computer systems, telemetry front end systems, terminals and graphic displays, micrographics equipment, embedded computer. GRA

N86-24517*# Mississippi State Univ., Mississippi State. Dept. of Physics.
PRELIMINARY DESIGNS FOR X-RAY SOURCE MODIFICATIONS FOR THE MARSHALL SPACE FLIGHT CENTER'S X-RAY CALIBRATION FACILITY
W. L. Croft *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 19 p refs (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 14B

N86-24615*# California Univ., La Jolla.
THE CONCEPT OF THE PINHOLE/OCCULTER FACILITY
Hugh S. Hudson *In* NASA. Marshall Space Flight Center Solar Flares and Coronal Physics Using P/OF as a Research Tool Apr. 1986 p 5-13 refs (For primary document see N86-24614 14-92)
(Grant NsG-7161)
Avail: NTIS HC A14/MF A01 CSCL 14B

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N86-23616*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SSME FUELSIDE PREBURNER TWO-DIMENSIONAL ANALYSIS
Thomas J. VanOverbeke and Russell W. Claus [1986] 19 p refs Prepared for presentation at the Central States Meeting of the Combustion Inst., Cleveland, Ohio, 5-6 May 1986
(NASA-TM-87299; E-3010; NAS 1.15:87299) Avail: NTIS HC A02/MF A01 CSCL 20H

The flow field within the fuelside preburner of the Space Shuttle Main Engine is calculated using a reacting flow code (REACT2D). Inlet and modeling parameters involved in the numerical calculation are systematically varied to establish the sensitivity of the calculated exit temperature profile. It is found that differences in the inlet equivalence ratio have a large effect on the turbine inlet temperature profile. A variety of preburner inlet modeling changes such as inlet turbulence level, modeling the gases as burned, unburned, premixed, or unmixed, are shown to have a smaller effect on the calculated turbine inlet temperature profile. Also, the form of finite differencing used is shown to have an effect on the temperature profile. Author

N86-23617# TRG, Inc., Syosset, N.Y.
DESIGN SOUNDING ROCKET PAYLOAD SYSTEM TO STUDY VEHICLE CHARGING PHENOMENA Final Report, 1 Oct. 1979 - 31 Dec. 1984
Robert S. Hills 29 May 1985 90 p
(Contract F19628-80-C-0019)
(AD-A162149; C-184; AFGL-TR-85-0131) Avail: NTIS HC A05/MF A01 CSCL 22/1

The objectives of this contract are the following: (1) reassemble and test the A31.603 rocket payload, previously flown at WSMR in January of 1978. Conduct spacecraft charging tests in a plasma using the vacuum chamber at Johnson Space Flight Center, Texas; (2) design a sounding rocket payload for the measurement of vehicle charging due to charge ejection in accordance with the results of the reassembly and retest of the A31.603 payload, and in accordance with specifications for the instrumentation for the spacecraft charging rocket-2 payload; (3) fabricate and test a negative charge ejection system; (4) fabricate and test rocket payload sensor systems to measure the vehicle-to-plasma potential difference; (5) fabricate and test sensor systems to measure and identify charged particle return to the payload; (6) fabricate and test sensor systems to measure rapid changes in vehicle potential; (7) fabricate and test a microprocessor-based sounding rocket experiment controller. (8) fabricate and test one set of ground support equipment; (9) integrate at contractor's facility the above sensor systems with a rocket payload structure and instrumentation provided by the government. GRA

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation, e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

N86-23618*# National Aeronautics and Space Administration, Washington, D.C.
THE SPACE TRANSPORTATION SYSTEM AND ITS IMPACT ON LATIN AMERICAN DEVELOPMENT
F. R. Chang Diaz Nov. 1985 56 p refs Transl. into ENGLISH of El Sistema de Transporte Espacial y su Impacto en el Desarrollo de Latinoamerica (Houston, Tex.), Jun. 1984 p 1-20 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. was prepared by NASA. Johnson Space Center
(Contract NASw-4005)
(NASA-TM-77684; NAS 1.15:77684) Avail: NTIS HC A04/MF A01 CSCL 22A

The three components of the Space Transportation System: the space shuttle, the permanent orbital space station and the transorbital vehicle are described. The stages of completion of the various plans are discussed and the impact of the project's implementation is discussed with particular reference to Latin America and with special emphasis on the telecommunications sector. Author

N86-23619# Los Alamos National Lab., N. Mex.
MOON BASE/MARS BASE TRANSPORTATION DEPOT
P. W. Keaton Sep. 1985 15 p refs
(Contract W-7405-eng-36)
(DE86-003275; LA-10552-MS) Avail: NTIS HC A02/MF A01

Placement of the next space outpost, after the low-Earth-orbit

space station, will strongly affect the evolution of future space programs. The outpost will store rocket fuel and offer a haven to space workers, as well as provide a transportation depot for long missions. Ideally, it must be loosely bound to the Earth, easy to approach and leave, and available for launch at any time. One Lagrange equilibrium point, L1(SE), between the Sun and the Earth and another, L2(EM), in the Earth-Moon system have excellent physical characteristics for an outpost; L1(SE), for example, requires less than 2% additional rocket propellant for docking there on the way to Moon bases or Mars bases. We apply the rocket problem, the two-body problem, and the three-body problem in discussing alternative locations for space depots. We conclude that Lagrange point halo orbits are the standard by which other concepts for transportation depots must be gauged. DOE

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications.*

N86-23620*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SPACE STATION WORKSTATION TECHNOLOGY WORKSHOP REPORT
Karen L. Moe, Curtis M. Emerson, David R. Eike (Carlow Associates, Fairfax, Va.), and Thomas B. Malone (Carlow Associates, Fairfax, Va.) Mar. 1985 135 p
(Contract NAS5-28597)
(NASA-CP-2414; NAS 4033-85-1DRE; NAS 1.55:2414) Avail: NTIS HC A07/MF A01 CSCL 22B

This report describes the results of a workshop conducted at Goddard Space Flight Center (GSFC) to identify current and anticipated trends in human-computer interface technology that may influence the design or operation of a space station workstation. The workshop was attended by approximately 40 persons from government and academia who were selected for their expertise in some aspect of human-machine interaction research. The focus of the workshop was a 1 1/2 brainstorming/forecasting session in which the attendees were assigned to interdisciplinary working groups and instructed to develop predictions for each of the following technology areas: (1) user interface, (2) resource management, (3) control language, (4) data base systems, (5) automatic software development, (6) communications, (7) training, and (8) simulation. This report is significant in that it provides a unique perspective on workstation design for the space station. This perspective, which is characterized by a major emphasis on user requirements, should be most valuable to Phase B contractors involved in design development of the space station workstation. One of the more compelling results of the workshop is the recognition that no major technological breakthroughs are required to implement the current workstation concept. What is required is the creative application of existing knowledge and technology.
Author

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support.* For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics.*

N86-23621*# Computer Sciences Corp., Hampton, Va.
THERMAL MODELING OF A METALLIC THERMAL PROTECTION TILE FOR ENTRY VEHICLES
Michael R. Wiese Apr. 1986 24 p refs
(Contract NAS1-17999)
(NASA-CR-178080; NAS 1.26:178080) Avail: NTIS HC A02/MF A01 CSCL 22B

The thermal Energy Flow Simulation (TEFS) computer program was developed to simulate transient heat transfer through composite solids and predict interfacial temperatures. The program and its usage are described. A simulation of the thermal response of a new thermal protection tile design for the Space Shuttle Orbiter is presented and graphically compared with actual data. An example is also provided which shows the program's usage as a design tool for theoretical models. Author

N86-23622*# National Aeronautics and Space Administration, Washington, D.C.
JAPAN'S PARTICIPATION IN SPACE STATION DESIGN: FEASIBILITY STUDY OF GaAs SOLAR CELLS FOR SPACE STATION APPLICATIONS
Mar. 1986 57 p Transl. into ENGLISH of "Bei Koku Uchu Kichi Keikaku Yobi Setsu Keisan ka GaAs Dei Tairo Denchi Seru No u Chu Kichi e No Tsuyosei No Kento" rept. ST-E-0739 National Space Development Agency of Japan, Japan, 18 Dec. 1985 p 1-44 Transl. by The Corporate Word, Pittsburgh, Pa.
(Contract NASw-4006)
(NASA-TM-88384; NAS 1.15:88384; ST-E-0739) Avail: NTIS HC A04/MF A01 CSCL 22B

The report gives the results of feasibility studies and a cost analysis done on GaAs solar battery cells for space stations. The studies and their results are as follows: (1) Cell size - The 2 x 4 cm cell size was found superior to the 4 x 4 cm cell; (2) Manufacturing technology - Overall, LPE crystal growth was found more suitable than MO-CVD. Current technology for post-growth processes and applying large-area cover glass can be used with few or no modifications; (3) Cell assemblies - Tests for mechanical and thermal stresses encountered from assembly through operation are recommended; (4) Procuring materials - Steps should be taken to avoid sharp price increases due to a speculative gallium market. There are no problems with arsenic materials; (5) Production facilities - The capital investment needed remains to be determined, but a working area of 4000 m2 will be required; (6) Cell costs to be determined; (7) Cell development-supply plan - Two-year lead time will be needed to develop the necessary technology and prepare for production. Author

N86-23623*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ANALYSIS OF A SINGLE-FOLD DEPLOYABLE TRUSS BEAM PRELOADED BY EXTENSION OF SELECTED FACE DIAGONAL MEMBERS
K. Chauncey Wu and Mark S. Lake Apr. 1986 17 p refs
(NASA-TM-87673; NAS 1.15:87673) Avail: NTIS HC A02/MF A01 CSCL 22B

A technique for preloading a deployable box truss beam by extension of one face diagonal per bay was studied to determine if it would result in uniform loading of truss joints without causing excessive truss deformations. Results indicate that it is possible to accomplish uniform loading in the beam region way from beam boundaries, whereas in the regions near boundaries the member loading becomes non-uniform with magnitudes greater than those in the uniform load region. Also, the type of deformation which results in the beam depends on the pattern of preloaded members. Author

N86-23624# Tokyo Univ. (Japan). Institute of Space and Astronautical Science.
METHOD OF PACKAGING AND DEPLOYMENT OF LARGE MEMBRANES IN SPACE
Koryo Miura Dec. 1985 11 p refs
(ISAS-618; ISSN-0285-6808) Avail: NTIS HC A02/MF A01

A new concept of packaging and deployment of large membranes in space is presented. The problem of biaxially folding of a plane is transferred to the elastic problem of a biaxially compressed infinite plate. After solving the problem, the plate thickness is reduced infinitesimally small, and thus the results represents the isometric transfer of an infinite plane subject to biaxial shortening. As a result, the concave polyhedral surface is discovered, which is composed of a repetition of a fundamental region, which is further composed of four congruent parallelograms. It is shown that the packaging and deployment by this surface geometry satisfies various requirements as to operations in space. Author

N86-23625# Tokyo Univ. (Japan). Institute of Space and Astronautical Science.

VACUUM-ENVIRONMENT AROUND SPACELAB-1

Masahisa Yanagisawa, Nobuki Kawashima, Susumu Sasaki, and Tatsuzo Obayashi Aug. 1985 8 p refs

(ISAS-617; ISSN-0285-6808) Avail: NTIS HC A02/MF A01

The background pressure for the SEPAC experiments (Space Experiments with Particle Accelerators) was monitored by the vacuum gauge on the Spacelab pellet. The pressure during the whole mission shows a clear relationship with the orbiter's velocity vector. When the gauge is screened by the orbiter from the relative flow of the upper atmosphere (wake condition), the pressure is constantly low, but much higher than that of the model atmosphere. At present, it is best explained by gas leakage from Spacelab or some of its instruments. When the gauge is open to the flow (ram condition), the pressure is linearly related to the cosine of he incident angle and has a maximum at normal incidence. The maximum is more than one order of magnitude higher than the model pressure. This is interpreted as escape of incident atmosphere from the Spacelab's surface with thermal velocity. Author

N86-23626*# Computer Sciences Corp., Greenbelt, Md.

NAVIGATION STUDY FOR LOW-ALTITUDE EARTH SATELLITES

P. R. Pastor, B. T. Fang, and C. P. Yee Dec. 1985 171 p refs (Contract NAS5-27888)

(NASA-CR-177855; NAS 1.26:177855; CSC/TM-85/6119) Avail: NTIS HC A08/MF A01 CSCL 22A

This document describes several navigation studies for low-altitude Earth satellites. The use of Global Positioning System Navigation Package data for LANDSAT-5 orbit determination is evaluated. In addition, a navigation analysis for the proposed Tracking and Data Aquisition System is presented. This analysis, based on simulations employing one-way Doppler data, is used to determine the agreement between the Research and Development Goddard Trajectory Determination System and the Sequential Error Analysis Program results. Properties of several geopotential error models are studied and an exploratory study of orbit smoother process noise is presented. Author

N86-23627# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

ARTIFICIAL SATELLITE ATTITUDE CONTROL USING A SELF-TUNING CONTROLLER

Jose Francisco Ribeiro, Joao Moro, and Antonio Felix Martins Neto Feb. 1986 6 p refs Presented at TELECON '85, Rio d Janeiro, Brazil, 10-13 Dec. 1985

(INPE-3789-PRE/884) Avail: NTIS HC A02/MF A01

A multivariable self-tuning attitude controller is proposed for use in a three axis stabilized sun-synchronous remote sensing satellite. By utilizing preprocessed measurements of the satellie sensors, a low order controller generates outputs that will drive gas jet or reaction wheel systems, keeping the on board observing camera pointed to the Earth Center and with angular velocities within a prescribed range. The controller parameters are updated on line by a variable forgetting factor least square method. Author

N86-23628*# Vanderbilt Univ., Nashville, Tenn. Dept. of Mechanical and Materials Engineering.

DISCUSSION OF FLIGHT EXPERIMENTS WITH AN ENTRY RESEARCH VEHICLE

J. Leith Potter 30 Jun. 1985 40 p refs

(Grant NAG1-549)

(NASA-CR-176724; NAS 1.26:176724; SASR-1) Avail: NTIS HC A03/MF A01 CSCL 22A

The focus of interest is the maneuvering flight of advanced entry vehicles operating at altitudes above 50 km and at velocities of 5 to 8 km/s. Information resulting in more accurate aerodynamic analysis is sought and measurement techniques that appear to be applicable are identified. Measurements discussed include: shock layer or boundary layer profiles of velocity, temperature, species mass fractions, and other gas properties associated with aerodynamic heating; surface energy transfer process; nonequilibrium flow processes and pressure distribution; separated, vortic leeside flow of nonequilibrium fluid; boundary layer transition on highly swept configurations; and shock and surface slip and gas/surface interaction. Further study should focus on evolving measurement techniques, installation requirements, and on identification of the portions of flights where successful results seem probable. B.G.

N86-23629*# Smithsonian Astrophysical Observatory, Cambridge, Mass.

ANALYTICAL INVESTIGATION OF THE DYNAMICS OF TETHERED CONSTELLATIONS IN EARTH ORBIT, PHASE 2 Quarterly Report, 22 Sep. - 21 Dec. 1985

Enrico Lorenzini, David A. Arnold, Mario D. Grossi, and Gordon E. Gullahorn Feb. 1986 53 p

(Contract NAS8-36606)

(NASA-CR-178754; NAS 1.26:178754; QR-3) Avail: NTIS HC A04/MF A01 CSCL 22A

The development of a two dimensional analytical model that describes the dynamics of an n-mass vertical tethered system is reported. Two different approaches are described: in the first one the control quantities are the independent variables while in the second one the Cartesian coordinates of each mass expressed in the orbiting reference frame are the independent variables. The latter model was used in the 3-mass version to simulate the dynamics of the tethered system in applications involving the displacement of the middle mass along the tether. In particular, issues related to reproducing predetermined acceleration profiles and g-tuning are reported. Author

N86-23630# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.

A COST ANALYST'S GUIDE TO SATELLITE AUTONOMY AND FAULT-TOLERANT COMPUTING

Paul S. Killingsworth 1985 22 p Presented at the 19th Annual Department of Defense Cost Analysis Symposium, Leesburg, Va., 17-20 Sep. 1985

(AD-A161853) Avail: NTIS HC A02/MF A01 CSCL 12/1

The trend in satellite design is toward greater autonomy in satellite functions, particularly in attitude determination and navigation. Fault-tolerant computing is a necessary condition for autonomy, and incurs costs in terms of computer memory, throughput, power and weight. Fault-tolerance and reliability issues need to be looked at and estimated early in the system development. This could prevent cost overruns due to lengthened test programs and unexpected redesigns. Finally, space logistics is becoming an area of increasing interest and study. The costs of space transportation and modular designs for on-orbit replacement of components need to be weighed against the cost of building increasingly intelligent and autonomous satellites. GRA

N86-23631# Texas A&M Univ., College Station.

A MODEL FOR PREDICTING THERMOMECHANICAL RESPONSE OF LARGE SPACE STRUCTURES Annual Technical Report, May 1984 - Apr. 1985

D. H. Allen and W. E. Haisler Jun. 1985 196 p

(Contract F49620-83-C-0067)

(AD-A162139; MM-4875-85-11; AFOSR-85-1016TR) Avail: NTIS HC A09/MF A01 CSCL 22/2

A model is being developed for predicting the thermomechanical response of large space structures to cyclic transient temperature loading conditions. The research is being conducted in the following stages: (1) selection and specialization of thermomechanical constitutive equations to be utilized in the analysis of large space structures; (2) construction (where necessary) of coupled energy balance equations (modified Fourier heat conduction equations) applicable to the constitutive models selected in item (1); (3) casting (where necessary) the resulting field laws into coupled and uncoupled variational principles suitable for use with the finite element method; (4) finite element discretization of the variational principles for several element types; (5) experimentation to determine material properties to be utilized in the constitutive models; and (6) parametric studies of the quasistatic and dynamic response of large space structures undergoing thermomechanically and environmentally degraded material properties. GRA

N86-23632# Georgia Inst. of Tech., Atlanta. Center for the Advancement of Computational Mechanics.
SIMPLIFIED NONLINEAR ANALYSIS OF LARGE SPACE-TRUSSES AND SPACE-FRAMES, USING EXPLICITLY DERIVED TANGENT STIFFNESSES AND ACCOUNTING FOR LOCAL BUCKLING Final Report, 1 May 1983 - 30 Apr. 1985
K. Kondoh, K. Tanaka, and S. N. Atluri Aug. 1985 193 p
(Contract F33615-83-K-3205)
(AD-A162319; GIT-CACM-SNA-14; AFWAL-TR-85-3079) Avail: NTIS HC A09/MF A01 CSCL 22/2

Simplified finite element methods for finite deformation, post-buckling analysis of large space trusses and space frames are presented. Arbitrarily large rigid translations and rigid rotations of each member are accounted for. Each 3-D truss member is assumed to withstand an axial force, while each 3-D frame member is assumed to withstand two bending moments, a twisting moment, and transverse and axial forces at each node. The influence of local (member) buckling on global instability is systematically examined. For both 3-D truss and frame members, explicit tangent stiffness matrices are derived. By explicit; it is meant that no element-wise basis functions are assumed and that no element-wise numerical integrations are involved. These explicit tangent stiffness matrices are very simply evaluated at any point in the load deformation history of a space truss, or space frame, undergoing large deformations, as well as in the postbuckled region of behavior of these structures. An arc-length method is implemented to trace the postbuckling behavior of these large space structures. A large number of examples are included to: (1) bring out the economy as well as accuracy of the simplified method developed; (2) indicate the effectiveness of the present method in creating reduced-order models of large space structures; and (3) delineate the process whereby the overall behavior of the structure can be vastly improved by controlling the deformation of individual members through active or passive mechanisms. GRA

N86-23633# Naval Postgraduate School, Monterey, Calif.
SPACECRAFT CONTAMINATION FROM A CHEMICAL LASER RING-JET PROGRESS REPORT Progress Report, Mar. - Aug. 1985
Joseph Falcovitz Nov. 1985 29 p
(AD-A162838; NPS67-85-010CR) Avail: NTIS HC A03/MF A01 CSCL 22/1

A review of work done at the Naval Postgraduate School (NPS) on the contaminating backflow from the exhaust plume of a chemical laser mounted on an Earth-orbiting spacecraft is presented. Various mechanisms that may give rise to a backflow are outlined, i.e., thermal backscattering, ambient scattering; and viscous effects. Detailed studies have been conducted at NPS on thermal backscattering. They are reviewed in this report, concluding that corrosive fluxes (HF,DF,F) due solely to this effect are negligible. The flux of light species (He,H2), however, is significant. GRA

N86-24511*# Florida Inst. of Tech., Melbourne. Dept. of Chemical Engineering.
SPACE STATION COMMON MODULE THERMAL MANAGEMENT: DESIGN AND CONSTRUCTION OF A TEST BED
Ronald G. Barile *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 25 p refs (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 22B

N86-24512*# Purdue Univ., Indianapolis, Ind. Dept. of Mechanical Engineering.
METHODOLOGY OF DESIGN AND ANALYSIS OF EXTERNAL WALLS OF SPACE STATION FOR HYPERVELOCITY IMPACTS BY METEOROIDS AND SPACE DEBRIS
Fahim A. Batla *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 32 p refs (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 22B

N86-24535*# Alabama Univ., Huntsville. Dept. of Mechanical Engineering.
ANALYTICAL DETERMINATION OF SPACE STATION RESPONSE TO CREW MOTION AND DESIGN OF SUSPENSION SYSTEM FOR MICROGRAVITY EXPERIMENTS
Frank C. Liu *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 36 p (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04

N86-24537*# Berry Coll., Mount Berry, Ga. Dept. of Physics.
A STUDY OF 35-GHZ RADAR-ASSISTED ORBITAL MANEUVERING VEHICLE/SPACE TELESCOPE DOCKING
Malcolm W. McDonald *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 31 p refs (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 22A

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography.*

N86-23634# Air Force Geophysics Lab., Hanscom AFB, Mass.
REAL TIME: AUTOMATIC VEHICLE POTENTIAL DETERMINATION FROM ESA (ELECTROSTATIC ANALYZER) MEASUREMENTS. PART 2: THE DISTRIBUTION FUNCTION ALGORITHM
Stanley L. Spiegel and Herbert A. Cohen 6 May 1985 20 p
(AD-A162072; AFGL-TR-85-0103(2)-Pt-2; AFGL-ERP-916(2)-Pt-2)
Avail: NTIS HC A02/MF A01 CSCL 22/2

A technique has been developed that uses electrostatic analyzer positive ion count measurements to compute plasma distribution functions to infer high altitude vehicle potential in real time. Author (GRA)

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N86-23635*# Wyle Labs., Inc., Huntsville, Ala.
A DATA BASE AND ANALYSIS PROGRAM FOR SHUTTLE MAIN ENGINE DYNAMIC PRESSURE MEASUREMENTS. APPENDIX B: DATA BASE PLOTS FOR SSME TESTS 901-290 THROUGH 901-414 Final Report

Thomas Coffin Jan. 1986 462 p
(Contract NAS8-34343)
(NASA-CR-178809; NAS 1.26:178809; TR-66338-01-App-B) Avail: NTIS HC A20/MF A01 CSCL 21H

A dynamic pressure data base and data base management system developed to characterize the Space Shuttle Main Engine (SSME) dynamic pressure environment is described. The data base represents dynamic pressure measurements obtained during single engine hot firing tesets of the SSME. Software is provided to permit statistical evaluation of selected measurements under specified operating conditions. An interpolation scheme is also included to estimate spectral trends with SSME power level. Flow dynamic environments in high performance rocket engines are discussed. E.A.K.

N86-23636*# Wyle Labs., Inc., Huntsville, Ala.
A DATA BASE AND ANALYSIS PROGRAM FOR SHUTTLE MAIN ENGINE DYNAMIC PRESSURE MEASUREMENTS. APPENDIX C: DATA BASE PLOTS FOR SSME TESTS 902-214 THROUGH 902-314 Final Report
Thomas Coffin Jan. 1986 47 p
(Contract NAS8-34343)
(NASA-CR-178810; NAS 1.26:178810; TR-66338-01-App-C) Avail: NTIS HC A03/MF A01 CSCL 21H

A dynamic pressure data base and data base management system developed to characterize the Space Shuttle Main Engine (SSME) dynamic pressure environment is reported. The data base represents dynamic pressure measurements obtained during single engine hot firing tests of the SSME. Software is provided to permit statistical evaluation of selected measurements under specified operating conditions. An interpolation scheme is included to estimate spectral trends with SSME power level. Flow Dynamic Environments in High Performance Rocket Engines are described. E.A.K.

N86-23637*# Wyle Labs., Inc., Huntsville, Ala.
A DATA BASE AND ANALYSIS PROGRAM FOR SHUTTLE MAIN ENGINE DYNAMIC PRESSURE MEASUREMENTS. APPENDIX D: DATA BASE PLOTS FOR SSME TESTS 750-047 THROUGH 750-111 Final Report
Thomas Coffin Jan. 1986 412 p
(Contract NAS8-34343)
(NASA-CR-178811; NAS 1.26:178811; TR-66338-01-App-D) Avail: NTIS HC A18/MF A01 CSCL 21H

Space Shuttle Main Engine power spectra and dynamic pressure measurements from hot test firing are reported. B.G.

N86-23638*# Wyle Labs., Inc., Huntsville, Ala.
A DATA BASE AND ANALYSIS PROGRAM FOR SHUTTLE MAIN ENGINE DYNAMIC PRESSURE MEASUREMENTS. APPENDIX E: DATA BASE PLOTS FOR SSME TESTS 750-112 THROUGH 750-118 Final Report
Thomas Coffin Jan. 1986 311 p
(Contract NAS8-34343)
(NASA-CR-178812; NAS 1.26:178812; TR-66338-01-App-E) Avail: NTIS HC A14/MF A01 CSCL 21H

Dynamic pressure measurements and power spectra obtained from hot test firing of the Space Shuttle Main Engine are reported for test stand A3. B.G.

N86-23639*# Wyle Labs., Inc., Huntsville, Ala.
A DATA BASE AND ANALYSIS PROGRAM FOR SHUTTLE MAIN ENGINE DYNAMIC PRESSURE MEASUREMENTS. APPENDIX F: DATA BASE PLOTS FOR SSME TESTS 750-120 THROUGH 750-200 Final Report
Thomas Coffin Jan. 1986 276 p
(Contract NAS8-34343)
(NASA-CR-178813; NAS 1.26:178813; TR-66338-01-App-F) Avail: NTIS HC A13/MF A01 CSCL 21H

A dynamic pressure data base and data base management system developed to characterize the Space Shuttle Main Engine (SSME) dynamic pressure environment is presented. The data base represents dynamic pressure measurements obtained during single engine hot firing tests of the SSME. Software is provided to permit statistical evaluation of selected measurements under specified operating conditions. An interpolation scheme is also included to estimate spectral trends with SSME power level. Author

N86-23640*# Rockwell International Corp., Canoga Park, Calif. Advanced Combustion Devices.
ATOMIZATION AND MIXING STUDY
A. Ferrenberg, K. Hunt, and J. Duesberg 30 Dec. 1985 375 p refs
(Contract NAS8-34504)
(NASA-CR-178751; NAS 1.26:178751; RI/RD85-312) Avail: NTIS HC A16/MF A01 CSCL 21H

The primary objective was the obtainment of atomization and mixing performance data for a variety of typical liquid oxygen/hydrocarbon injector element designs. Such data are required to establish injector design criteria and to provide critical inputs to liquid rocket engine combustor performance and stability analysis, and computational codes and methods. Deficiencies and problems with the atomization test equipment were identified, and action initiated to resolve them. Test results of the gas/liquid mixing tests indicated that an assessment of test methods was required. A series of 71 liquid/liquid tests were performed. B.G.

N86-23641*# Wyle Labs., Inc., Huntsville, Ala.
ENGINEERING EVALUATION OF SSME DYNAMIC DATA FROM ENGINE TESTS AND SSV FLIGHTS Final Report
Feb. 1986 570 p
(Contract NAS8-33508)
(NASA-CR-178807; NAS 1.26:178807; TR-64058-03) Avail: NTIS HC A24/MF A01 CSCL 21H

An engineering evaluation of dynamic data from SSME hot firing tests and SSV flights is summarized. The basic objective of the study is to provide analyses of vibration, strain and dynamic pressure measurements in support of MSFC performance and reliability improvement programs. A brief description of the SSME test program is given and a typical test evaluation cycle reviewed. Data banks generated to characterize SSME component dynamic characteristics are described and statistical analyses performed on these data base measurements are discussed. Analytical models applied to define the dynamic behavior of SSME components (such as turbopump bearing elements and the flight accelerometer safety cut-off system) are also summarized. Appendices are included to illustrate some typical tasks performed under this study. Author

N86-23642*# Continuum, Inc., Huntsville, Ala.
COMPUTATIONAL ANALYSIS OF THE SSME FUEL PREBURNER FLOW Final Report
Ten-See Wang and Richard C. Farmer 28 Feb. 1986 59 p refs
(Contract NAS8-35509)
(NASA-CR-178803; NAS 1.26:178803; CI-FR-0084) Avail: NTIS HC A04/MF A01 CSCL 21H

A computational fluid dynamics model which simulates the steady state operation of the SSME fuel preburner is developed. Specifically, the model will be used to quantify the flow factors which cause local hot spots in the fuel preburner in order to recommend experiments whereby the control of undesirable flow features can be demonstrated. The results of a two year effort to model the preburner are presented. In this effort, investigating the fuel preburner flowfield, the appropriate transport equations were numerically solved for both an axisymmetric and a three-dimensional configuration. Continuum's VAST (Variational Solution of the Transport equations) code, in conjunction with the CM-1000 Engineering Analysis Workstation and the NASA/Ames CYBER 205, was used to perform the required calculations. It is concluded that the preburner operational anomalies are not due to steady state phenomena and must, therefore, be related to transient operational procedures. Author

N86-23643# Aeronautical Research Labs., Melbourne (Australia).
FURTHER DEVELOPMENTS IN A PARAMETRIC STUDY OF RAMROCKET PERFORMANCE
Lincoln Erm Apr. 1985 24 p

(AD-A161906; ARL-AERO-PROP-TM-424) Avail: NTIS HC A02/MF A01 CSCL 21/5

The performance of a ramrocket is estimated for a set of reference conditions and then the effect on performance of variable altitude, radial injection of the primary jet, variable intake pressure recovery and different levels of secondary combustion efficiency are each examined in turn. The results are presented graphically in terms of specific impulse. GRA

N86-23644# Aerojet Strategic Propulsion Co., Sacramento, Calif.
AGING AND SURVEILLANCE PROGRAM MINUTEMAN 2/3 STAGE 2 PROGRAM PROGRESS Report, 15 Mar. - 31 Aug. 1985
Nov. 1985 272 p
(Contract F42600-84-D-1275)
(AD-A162884; ASPC-0162-06-SAAS-35) Avail: NTIS HC A12/MF A01 CSCL 21/8

This semiannual report provides results of tests conducted between 15 March 1985 and 31 August 1985 in support of the Aging and Surveillance program for the Minuteman 2 and 3 Stage 2 motors. The primary objectives of the program are to provide assurance that (1) the reliability of the presently deployed motor will not degrade within a projected replacement time of 17 years, and (2) the service life of the remanufactured motor will be equal to or greater than that of the presently deployed motor population. Also summarized are results of work completed in a number of special areas. Topics include initial testing of plug samples from a late production motor, dissection of a weathersealed motor, investigation of a propellant crack in a field-returned motor, investigation of early age-out motors, and evaluation of Stage 2 igniters for re-use in remanufactured motors. GRA

N86-23645# Florida Univ., Gainesville. Dept. of Engineering Sciences.
RD: A PROGRAM FOR AUTOMATED ROCKET DESIGN
G. E. Nevill, Jr., L. T. Adams, Jr., C. N. Asbury, W. J. Genemaras, and G. H. Paul Apr. 1985 108 p
(Contract W-7405-eng-48)
(DE86-002330; UCRL-15724) Avail: NTIS HC A06/MF A01

An experimental automated rocket design program (RD) developed in ROSIE/INTERLISP to run in VMS on a VAX 11/750 is described. Design problems are defined by the user in terms of the external shell configuration, thrust, weight, burn time and safety requirements. Reasonable candidate thrusters, feed systems and tank systems are identified using a coarse reasonableness criteria. Specific designs are then chosen using heuristic rules based on consideration of components characteristics including weight, capacity, size, safety, design maturity, use of special materials and compatibility with other components. The program's goal is to suggest as many promising designs as possible rather than to identify the single best design. A FORTRAN graphics package (GRAPHIX) then chooses the best positioning of the components of each design and displays them at the user's request. These programs can also be used for direct interrogation of the data base and for placement and display of user selected designs. RD/GRAPHIX together demonstrate the potential of an expert system approach to conceptual design of mechanical systems and structures. In addition, the programs are readily convertible to the design of other systems of interest to LLNL. DOE

N86-23864# Nagoya Univ. (Japan). Dept. of Aeronautical Engineering.
TWO-DIMENSIONAL ANALYSIS OF A FLOW IN AN MPD THRUSTER
Hiroyuki Yamada, Takashi Ao, and Toshi Fujiwara *In* Tokyo Univ. Proceedings of the Symposium on Mechanics for Space Flight Mar. 1985 p 67-76 refs (For primary document see N86-23858 14-34)
Avail: NTIS HC A08/MF A01

N86-24508*# Furman Univ., Greenville, S.C. Dept. of Computer Science.
A MONTE CARLO STUDY OF WEIBULL RELIABILITY ANALYSIS FOR SPACE SHUTTLE MAIN ENGINE COMPONENTS
Kenneth Abernethy *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 13 p refs (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 21H

N86-24524*# Tennessee Univ., Knoxville. Dept. of Mechanical and Aerospace Engineering.
INVESTIGATION AND MODELING OF SPACE SHUTTLE MAIN ENGINE SHUTDOWN TRANSIENT CHUGGING
Paul E. George, II *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 18 p (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 21H

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N86-23646# Iowa Univ., Iowa City. Dept. of Chemistry.
NEW APPROACHES TO THE SYNTHESIS OF FLUOROCARBONS Final Report, 15 Jul. 1984 - 14 Jul. 1985
Donald J. Burton 1 Oct. 1985 12 p
(Grant AF-AFOSR-0245-84)
(AD-A162020; AFOSR-85-1027TR) Avail: NTIS HC A02/MF A01 CSCL 07/4

This grant was issued under the DOD University Research Instrumentation for the purpose of upgrading equipment at the universities in order to perform research in support of National Defense. The instrument acquired was a Jeol FX-90Q(II) Fourier Transform (FT) Multi-Nuclear Magnetic Resonance Spectrometer System with the Omni Probe. The instrument also contains variable temperature observation, internal and external lock systems and computer control of irradiation frequencies. GRA

N86-23647# Massachusetts Univ., Amherst. Dept. of Polymer Science and Engineering.
ACID-CATALYZED DEGRADATION OF POLY(2-BUTYL-1,3,6-TRIOXOCANE
James C. W. Chien, C. Peter Lillya, and Bao-Bei Xu 21 Oct. 1985 33 p
(Contract N00014-83-K-0083)
(AD-A162038; TR-11) Avail: NTIS HC A03/MF A01 CSCL 07/3

Polyacetals, owing to the acid sensitivity of the acetal linkage, are attractive candidates for end uses in which acid sensitivity is a desirable property, e.g., photo- or electron-resists. Many polysaccharides belong to this general class and owe many of their special properties to the acetal linkage. We report here a study of acid-catalyzed decomposition of poly(2-butyl-1,36-trioxocane) under two sets of conditions: mild leading to depolymerization, and drastic leading to more profound degradation. A mechanism for depolymerization involving open chain oxycarbocation intermediates operates. GRA

N86-23648# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
THE SYNTHESIS AND THERMAL PROPERTIES OF ISOMERIC ACETYLENE TERMINATED QUINOXALINES Final Report, Jan. 1979 - Jun. 1981
Frederick L. Hedberg, Marilyn R. Unroe, and Donna L. Bush May 1985 35 p
(AD-A162157; AFWAL-TR-85-4036) Avail: NTIS HC A03/MF A01 CSCL 07/3

A mixture of the halogenated quinoxaline isomers, 3-(3-bromophenyl)-2-phenyl-6-iodoquinoxaline and 2-(3-bromophenyl)-3-phenyl-6-iodoquinoxaline, was synthesized and the two isomers were separated and purified. A substantial difference in solubility and melting point behavior was found between the isomers. The

halogen terminated isomers were converted individually to the corresponding isomeric acetylene terminated quinoxalines which exhibited analogous solubility and melting point differences. The glass transition temperatures of the individual acetylene terminated quinoxalines and of various mixtures all fell within a range from 33 C to 54 C. The presence of isomer mixtures was found to inhibit reversion from the amorphous state to the crystalline state. The significance of this effect and of solubility and melting point differences with respect to melt processing of acetylene terminated quinoxaline resin systems is discussed. Author (GRA)

N86-23649# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
AN INVESTIGATION OF ALTERNATE SYNTHESIS FOR 2,2'-BIS (PHENYLETHYNYL)-5,5' -DIAMINOBENZIDINE Final Report, Sep. 1979 - Sep. 1982
Alan A. Shaffer, Patricia M. Lindley, and Frederick L. Hedberg May 1985 51 p
(AD-A162197; AFWAL-TR-85-4038) Avail: NTIS HC A04/MF A01 CSCL 07/3

Several routes were investigated to develop an improved lower cost synthesis of the cited tetramine; a critical monomer used in forming the polyphenylquinoxaline polymer system with 2,2'-bis(phenylethynyl) moieties for intramolecular cyclization to the fused dibenzoanthracene structure. An immediate precursor to the tetramine 4-bromo-5-phenylethynyl-0-phenylenediamine was prepared in 43% overall crude yield from 0-nitroamide. Activated coupling through the aryl bromide using the tris-(triphenylphosphine) Ni(0) species was unsuccessful. Substrate chelation of the Ni(0) via the 0-diamine functionality was suggested as an inhibiting mechanism. Author (GRA)

N86-23650# Purdue Univ., West Lafayette, Ind. Dept. of Chemistry.
[STUDIES, USING MEASUREMENTS, TO EXPLAIN THE PROPERTIES OF FAST ION CONDUCTING GLASSES BY ELECTRICAL CONDUCTIVITY AND MECHANICAL RELAXATION AS WELL AS NORMAL CHARACTERIZATION MEASUREMENT]
C. A. Angell 30 Sep. 1985 30 p
(Contract N00014-84-K-0289)
(AD-A163029) Avail: NTIS HC A03/MF A01 CSCL 20/3

This document contains summaries of papers on the following topics: Mechanical vs Electrical Relaxation in AgI-based Fast Ion Conducting Glasses; Ambient Temperature Plastic Crystal Fast Ion Conductors (PLICFICS); All-Halide Superionic Glasses; Mechanical Relaxation by Mobile Ions Cu(+) and Ag(+) in Fast Ion Conducting Glasses; Recent Developments in Fast Ion Transport in Glassy and Amorphous Materials; Silver Alkali Halide Glasses and a Vitreous Analog of the RbAg4I5 Superionic Conductor; Fast Ion Phenomenology in Glassy Solids, Transport in Solids; and Recent Developments in Fast Ion Transport in Glassy and Amorphous Materials. GRA

N86-23651# Oak Ridge National Lab., Tenn.
EFFECT OF COPRODUCED ALCOHOLS AND KETONES ON THE EXTRACTION OF 1-BUTANOL FROM AQUEOUS SOLUTION BY THE ETHYL ESTERS OF SOYBEAN OIL FATTY ACIDS
W. L. Griffith, J. M. Googin, and A. L. Compere 1985 10 p refs Presented at the 4th Symposium on Separation Science and Technology for Energy Applications, Knoxville, Tenn., 20 Oct. 1985
(Contract DE-AC05-84OR-21400)
(DE86-002245; CONF-851011-3) Avail: NTIS HC A02/MF A01

Bacterial fermentations generally produce 1-butanol together with acetone, ethanol, 2-propanol, or 1-pentanol. The effect of these materials on the extraction of 1-butanol from aqueous solution by the ethyl ester of soybean oil fatty acids was determined using a factorial experimental design. Concentrations of 1-butanol ranged from 0.1 to 4.1% w/v, while the concentrations of coproduced alcohols and ketones ranged up to 4.0% w/v. Acetone, ethanol, and 2-propanol had little effect on 1-butanol extraction, while a slight increase in extraction appeared with increasing 1-pentanol. The extraction of acetone, ethanol, 2-propanol, and 1-pentanol was not measured. DOE

N86-23652# Oak Ridge National Lab., Tenn.
REACTION OF FORMALDEHYDE AND NITRIC ACID IN A REMOTELY OPERATED THERMOSIPHON EVAPORATOR
R. Hall, B. D. Patton, and P. A. Haas 1985 7 p Presented at the American Nuclear Society Winter Meeting, San Francisco, Calif., 10 Nov. 1985
(Contract DE-AC05-84OR-21400)
(DE86-002453; CONF-851115-33) Avail: NTIS HC A02/MF A01

Conditions have been developed for the safe and successful use of a method for reacting formaldehyde with excess nitric acid, while simulataneously concentrating a fissile uranium nitrate solution. This process, which is being conducted in a remotely operated thermosiphon evaporator, has been adapted to plant scale and is being used to process multikilogram batches. DOE

N86-23653# Sandia National Labs., Albuquerque, N. Mex.
RETENTION AND THERMAL RELEASE OF OXYGEN IMPLANTED IN GRAPHITE
W. R. Wampler and D. K. Brice 1985 11 p Presented at the 32nd National Vacuum Symposium and Topical Conference, Houston, Tex., 19 Nov. 1985
(Contract DE-AC04-76DP-00789)
(DE86-003235; SAND-85-1266C; CONF-851174-15) Avail: NTIS HC A02/MF A01

The retention of oxygen implanted in graphite at 1.5 and 3 keV was measured as a function of fluence. At fluences less than 10 to the 16th power O/sq cm the oxygen was all retained, but at higher fluences the retention saturated. Models describing the retention are discussed which include the effects of sputtering and a saturation limit to the local oxygen concentration. Thermal release of oxygen implanted to saturation at room temperature began at 250C and was 90% completed by 750C. DOE

24 COMPOSITE MATERIALS

Includes laminates.

N86-23654 Virginia Univ., Charlottesville.
TRANSVERSE STRENGTH IMPROVEMENT OF COMPOSITES Ph.D. Thesis
Annette Teng Cheung 1984 157 p
Avail: Univ. Microfilms Order No. DA8515504

Tensile tests of SiC monofilament reinforced composites showed transverse strengths less than 4000 psi (28 MPa). Low strength was due mainly to poor SiC to Al matrix bonding. One solution was to make hybrid composites utilizing a different and smaller type of fiber to reinforce the transverse direction without adversely affecting axial strength. The reinforcing fibers used were the continuous Nicalon (SiC) and Fiber FP(Al2O3) multifilaments and the Silag whiskers (SiC). Measurements established that the Silag whiskers provided effective reinforcement resulting in ultimate tensile stresses up to 50,000 psi (345 MPa). Fracture and microstructural analyses of Silag composites and hybrids showed many features such as low fiber pullout population and the presence of three types of brittle particulates, which if eliminated could have raised strengths substantially. Dissert. Abstr.

N86-23655 Rensselaer Polytechnic Inst., Troy, N.Y.
IMPROVING THE STRENGTH PREDICTION FOR ADVANCED COMPOSITE MATERIAL WITH STRESS CONCENTRATION Ph.D. Thesis
Tsay-Hsin Gilbert Hu 1985 296 p
Avail: Univ. Microfilms Order No. DA8528661

The macro-mechanical approach is used to investigate the stress concentration problem for Advanced Composite Material. Two modifications of the Average Stress Criterion and one modification of the Weibull strength theory are proposed to improve the accuracy of notched strength prediction for composites. The experimental data from both uniaxial and biaxial loading condition are used to assess the validity and accuracy of these modifications. For the uniaxial loading condition, a large scale testing program

has been conducted to generate the experimental data. Five replicates for each configuration seem to be an optimum compromise between expenses and accuracy. Notch type, notch size, and lay-up are the parameters for this investigation. Meanwhile, the theoretical stress distribution of notched specimen is obtained from a finite element analysis. The most suitable modification can be determined by best fitting of all experimental data.
Dissert. Abstr.

N86-23656 Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.
THE STRENGTH OF MECHANICALLY FASTENED JOINTS IN KEVLAR REINFORCED COMPOSITE MATERIALS
F. L. Matthews and P. Kalkanis Oct. 1984 162 p refs
(Contract MOD(PE)-2037/0258-XR/STR)
(BR93823) Avail: NTIS HC A08/MF A01

Structural use of Kevlar fiber reinforced plastic was examined by an experimental analysis of mechanical joints in various types of laminates, using woven fabric in 913 resin. Static tests on riveted joints (solid and hollow rivets) as well as pinned and bolted joints were carried out. Riveted joints in CFRP were tested for comparison. The investigation isolated variables such as geometric factors, bolt clamping pressure, and ply orientation. The effect of clamping load on rivets joints with solid rivets was investigated. It is found that the compressive properties of Kevlar fiber, combined with the characteristics of woven fabrics, cause unexpected behavior. Compared to CFRP laminates, the KFRP specimens exhibit metal-like features at failure. Strength depends strongly on lay-up and the imposition of through-thickness clamping causes a change in failure mode. Author (ESA)

N86-23657*# National Aeronautics and Space Administration, Washington, D.C.
FAILURE CRITERION OF GLASS FABRIC REINFORCED PLASTIC LAMINATES
Osamu Haga, Noriyuki Hayashi, and Kazuo Kasuya Apr. 1986 11 p refs Transl. into ENGLISH from "Glass Cloth Sekiso Kyoka Plastic no Hakai Kijun" (Japan), v. 25, no. 273, Jun. 1976 p 516-520 Previously announced in IAA as A76-41242 Transl. by SCITRAN, Inc., Santa Barbara, Calif. Original doc. was prepared by Chiba Univ., Japan
(Contract NASw-4004)
(NASA-TM-88406; NAS 1.15:88406) Avail: NTIS HC A02/MF A01 CSCL 11D

Failure criteria are derived for several modes of failure (in unaxial tensile or compressive loading, or biaxial combined tensile-compressive loading) in the case of closely woven plain fabric, coarsely-woven plain fabric, or roving glass cloth reinforcements. The shear strength in the interaction formula is replaced by an equation dealing with tensile or compressive strength in the direction making a 45 degree angle with one of the anisotropic axes, for the uniaxial failure criteria. The interaction formula is useful as the failure criterion in combined tension-compression biaxial failure for the case of closely woven plain fabric laminates, but poor agreement is obtained in the case of coarsely woven fabric laminates. Author

N86-23658*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
INVESTIGATION OF FIBER BRIDGING IN DOUBLE CANTILEVER BEAM SPECIMENS
W. S. Johnson and P. D. Managalgiri Apr. 1986 21 p refs
(NASA-TM-87716; NAS 1.15:87716) Avail: NTIS HC A02/MF A01 CSCL 11D

The possibility to eliminate fiber bridging or at least to reduce it, and to evaluate an alternative approach for determination of in situ mode 7 fracture toughness values of composite matrix materials were investigated. Double cantilever beam (DCB) specimens were made using unidirectional lay-ups of T6C/Hx205 composite material in which the delaminating halves were placed at angles of 0, 1.5, and 3 degrees to each other. The small angles between the delaminating plies were used to avoid fiber nesting without significantly affecting mode I Teflon insert. The DCB specimens were fabricated and it was found that: (1) the extent which fiber bridging and interlaminar toughness increase with crack length can be reduced by slight cross ply at the delamination plane to reduce fiber nesting; (2) some fiber bridging may occur even in the absence of fiber nesting; (3) the first values of toughness measured ahead of the thin Teflon insert are very close to the toughness of the matrix material with no fiber bridging; (4) thin adhesive bondline of matrix material appears to give toughness values equal to the interlaminar toughness of the composite matrix without fiber bridging. E.A.K.

N86-23659*# McDonnell-Douglas Corp., Long Beach, Calif.
GRAPHITE/EPOXY COMPOSITE STIFFENED PANEL FABRICATION DEVELOPMENT Final Report
R. J. Palmer Mar. 1984 135 p refs
(Contract NAS1-12675)
(NASA-CR-172204; NAS 1.26:172204) Avail: NTIS HC A07/MF A01 CSCL 11D

This report describes the manufacturing development procedures used to fabricate a series of carbon/epoxy panels with integrally molded stiffeners. Panel size was started at 6 inches by 18 inches and one stiffener and increased to 30 inches by 60 inches and six integral stiffeners. Stiffener concepts were optimized for minimum weight (or mass) to carry stress levels from 1500 lbs/inch to 25,000 lbs/inch compression load. Designs were created and manufactured with a stiffener configuration of integrally molded hat, J, I, sine wave I, solid blade, and honeycomb blade shapes. Successful and unsuccessful detail methods of tooling, lay-up methods, and bagging methods are documented. Recommendations are made for the best state-of-the-art manufacturing technique developed for type of stiffener construction.
Author

N86-23660*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
COMBINED BEARING AND BYPASS LOADING ON A GRAPHITE/EPOXY LAMINATE
J. H. Crews, Jr. and R. A. Naik Apr. 1986 35 p refs
(NASA-TM-87705; NAS 1.15:87705) Avail: NTIS HC A03/MF A01 CSCL 11D

A combined experimental and analytical study was conducted to determine the behavior of a graphite/epoxy laminate subjected to combined bearing and bypass loading. Single-fastener quasi-isotropic specimens were loaded at various bearing-bypass ratios until damage was produced at the fastener hole. Damage-onset strengths and damage modes were then analyzed using local hole-boundary stresses calculated by a finite-element analysis. The tension data showed the expected linear interaction for combined bearing and bypass loading with damage developing in the net-section tension mode. However, the compression bearing-bypass strengths showed an unexpected interaction involving the bearing mode. Compressive bypass loads reduced the bearing strength by decreasing the bolt-hole contact arc and thus increasing the severity of the bearing loads. The bearing stresses at the hole boundary were not accurately estimated by superposition of the stress components for separate bearing and bypass loading. However, superposition produced reasonably accurate estimates for tangential stresses especially near the specimen net-section.
Author

N86-23661*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FUNDAMENTAL STUDIES OF LOW VELOCITY IMPACT RESISTANCE OF GRAPHITE FIBER REINFORCED POLYMER MATRIX COMPOSITES Ph.D. Thesis
Kenneth J. Bowles Nov. 1985 241 p refs Previously announced as N86-10288
(NASA-TM-86886; E-2188; NAS 1.15:86886) Avail: NTIS HC A11/MF A01 CSCL 11D

A study was conducted to relate the impact resistance of graphite fiber reinforced composites with matrix properties through gaining an understanding of the basic mechanics involved in the deformation and fracture process, and the effect of the polymer

matrix structure on these mechanisms. It was found that the resin matrix structure influences the composite impact resistance in at least two ways. The integration of flexibilizers into the polymer chain structure tends to reduce the T sub g and the mechanical properties of the polymer. The reduction in the mechanical properties of the matrix does not enhance the composite impact resistance because it allows matrix controlled failure to initiate impact damage. It was found that when the instrumented drop-weight impact tester is used as a means for assessing resin toughness, the resin toughness is enhanced by the ability of the clamped specimen to deflect enough to produce sufficient membrane action to support a significant amount of the load. The results of this study indicate that crossplied composite impact resistance is very much dependent on the matrix mechanical properties. Dissert. Abstr.

N86-23662# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Structures Lab.
CEMENTITIOUS MIXTURES FOR SEALING EVAPORITE AND CLASTIC ROCKS IN A RADIOACTIVE-WASTE REPOSITORY Final Report
Lillian D. Wakeley and Della M. Roy Sep. 1985 19 p
(Contract DE-AC02-83CH10140)
(AD-A161865; WES/MP/SL-85-16) Avail: NTIS HC A02/MF A01 CSCL 11/1

Cement-based mixtures were proportioned for sealing a potential geologic repository for high-level radioactive waste in evaporite and related rock strata. The slightly expansive cementitious mixtures were based on Class H portland cement and Class C fly ash, with silica flour and calcium sulfate additives, and a low ratio of water to cementitious solids (w/s = 0.32). Both a salt-free and a salt-containing version were used in tests with anhydrite, siltstone, and halite. Although it is difficult to achieve strong bonding between anhydrite and cement-based mixtures, tensile bond strengths, interface permeability, and other properties of the composites as a whole indicate achievement of the desired chemical and physical compatibility between these materials. Integrity of bonding and low permeability to water (on the order of 0.000001 darcy) suggest the likelihood of attaining durable sealing of repository access shafts and boreholes through the use of such chemically tailored cementitious mixtures. Rock samples used in these sealing studies were obtained from various areas throughout the United States. The data in the present paper represent results for rocks obtained from the Palo Duro Basin, Tex., and, as such, typify bedded-salt strata. Author (GRA)

N86-23663# Royal Aircraft Establishment, Farnborough (England).
FLEXURAL PROPERTIES OF CARBON FIBRE CLOTH/WOOD VENEER LAMINATES
J. H. Sewell Apr. 1985 23 p
(AD-A161921; RAE-TM-MAT-STR-1055; DRIC-BR-96647) Avail: NTIS HC A02/MF A01 CSCL 11/5

Flexural tests have been made on epoxy or phenolic resin bonded hybrid laminates comprising carbon fiber cloth layers on wood veneer cores. Breaking loads and stiffnesses of many of the hybrids exceed those of all carbon fiber cloth laminates of the same weight per unit area of panel. This improvement in flexural properties can be accompanied by a significant decrease in materials costs owing to the replacement of expensive carbon fiber cloth by cheap wood veneers. Significant weight savings may be achieved if carbon fiber laminates are replaced by hybrid laminates having the same flexural breaking strengths or stiffnesses. GRA

N86-23664# Metal Matrix Composites Information Analysis Center, Santa Barbara, Calif.
A BRIEF INTRODUCTION TO METAL MATRIX COMPOSITES MATERIALS AND TECHNOLOGY
Louis A. Gonzalez Jan. 1985 14 p Presented at Advanced Materials Workshop, San Luis Obispo, Calif., 10-11 Dec. 1984
(Contract DLA900-80-C-4095)
(AD-A161954; MMCIAC-000663) Avail: NTIS HC A02/MF A01 CSCL 11/4

This paper presents a general introduction to metal matrix composites, including discussions on reinforcement and matrix materials, physical and mechanical properties of the composites, applications of the materials, and fabrication methods. GRA

N86-23665# Rensselaer Polytechnic Inst., Troy, N.Y. Dept. of Civil Engineering.
ANALYSIS OF PROGRESSIVE MATRIX CRACKING IN COMPOSITE LAMINATES Final Report, 1 Sep. 1982 - 31 Aug. 1984
George J. Dvorak 31 Mar. 1985 70 p
(Grant AF-AFOSR-0308-82)
(AD-A162220; AFOSR-85-1064TR) Avail: NTIS HC A04/MF A01 CSCL 11/4

This report summarizes recent results of studies on progressive ply cracking in fibrous laminates. Evaluation of stiffness changes caused by systems of aligned slit cracks which are parallel to the fiber direction in a unidirectional composite lamina is discussed. Results obtained by the self-consistent method are presented. Next, a procedure for estimating instantaneous crack densities and stiffness changes in a lamina subjected to a prescribed strain history is outlined. These results are extended to analysis of laminated composite plates under in-plane stresses. Specific examples and comparisons of analytical and experimental results are presented for two graphite-epoxy systems. GRA

N86-23666# Massachusetts Inst. of Tech., Cambridge.
STRUCTURE-PROPERTY RELATIONSHIPS IN INTERCALATED GRAPHITE Semiannual Report, 1 Oct. 1984 - 31 Mar. 1985
Mildred S. Dresselhaus and Gene Dresselhaus 10 Jul. 1985 22 p
(Contract F49620-83-C-0011)
(AD-A162326; AFOSR-85-0995TR) Avail: NTIS HC A02/MF A01 CSCL 20/12

Experimental and theoretical studies have been carried out relevant to the structural, lattice electronic, magnetic and superconducting properties of synthetic metals prepared by intercalating graphite. New synthesis methods have been developed for preparing magnetic transition metal chloride and potassium-hydrogen graphite intercalation compounds. The use of ion implantation to enhance intercalation has been explored and promising results have been obtained. Structural studies using high resolution X-ray scattering and transmission electron microscopy have been applied to study two-dimensional structural phase transitions such as the commensurate to incommensurate stripe phase transition in bromine intercalated graphite and commensurate to glass phase transition in antimony pentachloride intercalated graphite. The construction of a Raman microprobe allows study of the spatial homogeneity (to 2 micron resolution) of the staging in specific intercalated graphite samples. The high field magnetoresistance anomaly in graphite identified with a charge density wave has been further explored with particular emphasis given to the role of impurities in pair breaking phenomena and pulsed electric fields in nonlinear nonohmic effects. The theoretical model developed to explain the superconducting behavior in the first stage alkali metal compounds has guided studies on superconducting graphite intercalation compounds with higher transition temperatures with particular relevance to their superconducting behavior and their related Fermi surface and phonon mode properties. Author (GRA)

N86-23667# Drexel Univ., Philadelphia, Pa. Dept. of Mechanical Engineering and Mechanics.
FRACTURE BEHAVIOR OF BORON ALUMINUM COMPOSITES AT ROOM AND ELEVATED TEMPERATURES Final Report, 1 Apr. 1979 - 14 Apr. 1985
Jonathan Awerbuch Apr. 1985 265 p
(Grant AF-AFOSR-0079-79)
(AD-A162352; AFOSR-85-1099TR) Avail: NTIS HC A12/MF A01 CSCL 11/4

The results of research work on the deformation characteristics and failure mechanisms and processes of center-notched boron/aluminum laminates at room and elevated temperature are

described. This program has focused on the deformation characteristics in both the elastic and inelastic ranges, crack tip damage growth, notch sensitivity, toughness, failure mechanisms and processes and failure modes. The primary experimental technique has been to utilize the interferometric displacement gage (IDG) through which the actual crack opening displacement (COD) could be measured at room and elevated temperatures, resulting in precise load-COD and local compliance curves. Special attention has also been given to nondestructive examination techniques, in particular the acoustic emission technique, for monitoring internal damage initiation and progression during quasi-static and low cycle fatigue loading. Microstructural studies of the fracture surface morphologies have been conducted as well. The analytical study has focused in three major directions, namely: (1) predicting the elastic behavior; (2) application of semi-empirical fracture models for predicting the notch sensitivity; and (3) application, extension and modifications of approximate mechanistic models for predicting the deformation characteristics of unidirectional composites.
Author (GRA)

N86-23668# Aerotherm Acurex Corp., Mountain View, Calif.
IMPROVED PROCESSING OF CARBON-CARBON COMPOSITES Final Annual Report, Aug. 1984 - Sep. 1985
J. E. Zimmer and R. L. Weitz Nov. 1985 34 p
(Contract N00014-81-C-0641)
(AD-A162887; TR-85-21/ATD; FAR-4) Avail: NTIS HC A03/MF A01 CSCL 07/4

The objectives of this research program were to investigate the use of a catalyst to increase the char yield of petroleum pitch and thus increase the processing efficiency of carbon-carbon composites, and to investigate the use of an alternate pitch that forms a fine-isotropic matrix microstructure which may improve the interlaminar shear strength of bidirectional carbon-carbon composites. After the first carbonization and heat-treatment cycle, the composite with A240 petroleum-pitch matrix precursor with 20 w/o AlCl3 had a 4 percent higher bulk density. The composite with a fine-isotropic matrix microstructure from a thermal pitch from vacuum-distilled bottoms did not have higher interlaminar shear strength. This matrix was more viscous and did not infiltrate well the fiber bundles through which the shear fracture occurred. Further work is needed to better understand the relationships between char yield, viscosity, and microstructure, and to optimize these properties of the pitch matrix precursors. Author (GRA)

N86-24513*# Alabama Univ., Huntsville. Dept. of Mechanical Engineering.
DEVELOPMENT OF COMPOSITE MATERIAL TEST METHODOLOGY FOR FRACTURE TOUGHNESS/DAMAGE TOLERANCE
Mark V. Bower *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 21 p refs (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 11D

N86-24522*# Embry-Riddle Aeronautical Univ., Daytona Beach, Fla. Dept. of Aeronautical Engineering.
PRELIMINARY DESIGN METHODS FOR FIBER REINFORCED COMPOSITE STRUCTURES EMPLOYING A PERSONAL COMPUTER
Charles N. Eastlake *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 27 p refs (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 11D

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*

N86-23669 Princeton Univ., N. J.
STUDIES OF SLURRY DROPLET COMBUSTION AND BORON PARTICLE IGNITION Ph.D. Thesis
Paul Joseph Antaki 1986 214 p
Avail: Univ. Microfilms Order No. DA8529771

In the study of slurry droplet combustion, the transient droplet processes of liquid vaporization and internal heat conduction are investigated for two droplets models. The rigid porous shell model applies to a droplet with a large initial volume fraction of solid particles, and a constant overall droplet diameter. The contracting sphere model applies to a droplet with a small initial volume fraction of solid particles, and a diameter that decreases during part of the liquid vaporization period. For both models, the coupled equations for the rate of liquid surface regression and internal heat conduction are solved approximately by matched asymptotic expansions. The large or small expansion parameter is the ratio of the energy required to raise the slurry mixture to the liquid vaporization temperature, to that required for liquid vaporization. Results for both models include approximate expressions for liquid vaporization time, liquid surface regression and internal heat conduction. Selected results for both models are tested experimentally by vaporizing and buring the liquid JP-10 from single JP-10/boron droplets, suspended on quartz fibers in room temperature air. Dissert. Abstr.

N86-23670 Texas Univ., Austin.
DEVELOPMENT OF AN EIGHT-STEP KINETICS MECHANISM FOR PROPANE AND ITS APPLICATION IN A TRANSIENT, THIN GAP, ENGINE MODEL Ph.D. Thesis
Thomas Merill Kiehne 1985 464 p
Avail: Univ. Microfilms Order No. DA8527585

An accurate eight step kinetics mechanism for the oxidation of propane which is based on previous research was developed in ignition delay studies and investigations of freely propagating and quenching flames. Results from a detailed kinetics model and available experimental data were used for comparison and verification. One dimensional transient calculations were performed at pressures ranging from one to 40 atmospheres, unburned gas temperatures from 400 to 500 K, and near stoichiometric equivalence ratios. The detailed kinetics results confirm the existence of extensive postquench burnup of propane after the time of flame arrival at the wall. Based on the detailed kinetics results, an eight-step kinetics model developed from experiment is shown to be deficient in certain key areas. With the intent of extending the shear free, one dimensional, wall quench calculations to a two dimensional, transient, laminar shear flow enrichment, a thin gap model of combustion near top-dead-center in a piston engine is developed. This model couples the radial, compressible momentum equation to the axial flame equations with boundary conditions appropriate to enclosed flow in an engine cylinder. Cold flow calculations are used to establish pressure and, therefore, Reynold's number effects in both planar and axisymmetric geometries. Dissert. Abstr.

N86-23671# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Structures Lab.
DISTRIBUTION OF CHLORIDE IN A SALT-SATURATED GROUT IN CONTACT WITH ROCK SALT Final Report
Lillian D. Wakeley and J. P. Burkes Sep. 1985 18 p
(Contract FAO-21-2348)
(AD-A161866; WES/MP/SL-85-15) Avail: NTIS HC A02/MF A01 CSCL 07/4

Bond strength of a sodium chloride-saturated grout to rock salt suggested chemical bonding existed across the interface.

Chemical analyses using scanning electron microscopy/energy-dispersive X-ray spectroscopy of various locations in the grout showed a significantly greater quantity of chloride near the interface than near the perimeter of specimens. The resultant concentration of chloride is at least partially controlled by the proximity of rock salt. Author (GRA)

N86-23672# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
SAMPLE DIGESTION AND DRYING TECHNIQUES FOR OPTIMAL RECOVERY OF MERCURY FROM SOILS AND SEDIMENTS
James H. Cragin and Brian T. Foley Sep. 1985 21 p
(AD-A161948; CRREL-SR-85-16; AMXTH-TE-TR-85039) Avail: NTIS HC A02/MF A01 CSCL 08/4

Mercury in soils and sediments can be accurately determined over the concentration range of 0.04 to 2 micrograms Hg/g using amalgamation on thin gold films. Relative standard deviation of analysis is about 10%. A mild sample dissolution technique, involving HNO3 at 75 C, produced quantitative Hg recoveries for certified sediment samples and recoveries equivalent to those of rigorous Parr-bomb digestions for other soil and sediment samples. Oven drying of samples at 150 C resulted in significant losses of Hg from both soil and sediment samples. Air drying, oven drying at 60 C or freeze drying resulted in Hg recoveries that agreed within 20% of those for undried samples. Thus, any one of these three comparable methods is recommended for Hg determinations in soils and sediments. GRA

N86-23673# Frequency Systems, Inc., Nashua, N.H.
NEW DIAZO PROCESS Technical Report, 3 Dec. 1984 - 2 Dec. 1985
Sidney K. Tally 2 Dec. 1985 37 p
(Contract MDA903-85-C-0002; ARPA Order 5154)
(AD-A161962) Avail: NTIS HC A03/MF A01 CSCL 07/3

This project was initiated to explore diazo type compound with spectral response at 520 nm, and stability at ambient storage conditions. Such compounds would permit the direct copying of blue prints and result in major time and dollar savings to blueprint users including federal and municipal government agencies, the military, large and small industries and the construction industry. The photochemical sensitivity of the aromatic diazonium salts used in conventional diazo copying systems is limited to a narrow spectral region in the near ultraviolet and the blue, with maximum sensitivity from 375 nm to 400 nm. A new category of diazonium compound, with light sensitivity in the visible spectrum from 500 to 540 nm has been the goal of this project. There were four compounds picked to explore: 7-N,N-dimethylamino-2-fluorene diazonium chloride; 6-N,N-dimethylamino-1-pyrene diazonium chloride; 7-N,N-dimethylamino-2-pyrene diazonium chloride; and 7-N,N-dimethylamino-3-dibenzopyran diazonium chloride. These four compounds did not produce the required results. Naphthalene diazonium compounds meet the criteria specified for compounds to be investigated. Both 5-dimethylamino-1-napthalene diazonium chloride and 6-dimethylamino-2-naphthalene diazonium chloride possess the relatively long electrically conductive paths between appended polar nitrogens. GRA

N86-23674# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Structures Lab.
SULFATE RESISTANCE OF HYDRAULIC CEMENTS CONTAINING BLAST-FURNACE SLAG Final Report
Alan D. Buck Sep. 1985 19 p Presented at a Workshop, Slag Cements: Research and Practice, 12-14 Mar. 1984, University Park, Pa.
(AD-A161985; WES/MP/SL-85-14) Avail: NTIS HC A02/MF A01 CSCL 11/2

As part of one US Army Corps of Engineers research program and one American Society for Testing and Materials (ASTM) cooperative program performed in the Concrete Technology Division of the Structures Laboratory of the US Army Engineer Waterways Experiment Station in the 1970's, five portland blast-furnace slag cements were tested for sulfate resistance. The major intent of this program was to develop a new standardized test for determining sulfate resistance that would be more applicable for testing blended cements than ASTM C 452. The test now exists; it is ASTM C 1012-84. That work included characterization of materials, periodic expansion measurements, periodic determinations of relative modulus of elasticity. Periodic chemical analysis of test solutions, and examination of the paste portion of mortar bars by X-ray diffraction after expansion testing. This report concentrates on expansion results, posttest examination by XRD, and materials characteristics. GRA

N86-23675# Texas Univ., Austin. Dept. of Chemistry.
DEVELOPMENT OF PRACTICAL MO TECHNIQUES FOR THE PREDICTION OF THE PROPERTIES AND BEHAVIOR OF MATERIALS Final Scientific Report, 1 Nov. 1982 - 30 Sep. 1985
Michael J. S. Dewar 8 Oct. 1985 23 p
(Contract F49620-83-C-0024)
(AD-A161992; AFOSR-85-1028TR) Avail: NTIS HC A02/MF A01 CSCL 07/2

A third generation semiempirical SCF MO treatment (AM1) has been developed in which the weaknesses of MNDO, in particular failure to reproduce hydrogen bonds, have been overcome. MNDO has been parameterized for Zn, Hg, Ge, Sn, Pb, Br, and I and reparametrized for Si and S. A version of MNDO with d AOs has been parametrized for chromium. Computer programs have been improved and collected into a single package (MOPAC) which allows calculations of a wide variety of molecular properties, and additional graphics packages developed. Extensive calculations for pericyclic reactions has led to a new general rule, that multibond processes are not normally synchronous. The Diels-Alder reactions in particular have been shown to involve unsymmetrical transition states. Studies of aniotic nucleophilic substitution have shown that the barriers in solution can be due entirely to desolvation of the anion, a result of major theoretical significance. A new explanation of the rates and specificities of enzyme reactions, refutation of FO Theory as an effective general treatment of chemical reactions. A new interpretation of sigma interactions in molecules (sigmaconjugation), and evidence that tunnelling can play a more general role in chemistry than previously thought have been developed. GRA

N86-23676# SRI International Corp., Menlo Park, Calif.
LASER-INDUCED KINETICS: AN EXPERIMENTAL AND THEORETICAL PROGRAM Final Report, 1 Oct. 1982 - 30 Sep. 1985
N. Selamoglu, M. J. Rossi, and D. M. Golden 25 Oct. 1985 78 p
(Contract F49620-83-K-0001)
(AD-A161994; AFOSR-85-1097TR) Avail: NTIS HC A05/MF A01 CSCL 07/5

The kinetics of CF3 and CH3 radical reactions have been investigated using the VLPO method. The reactions of interest were radical recombination and metathetical halogenation (Br-2, C-12). In addition to yielding gas-phase reaction rates, these studies pointed out the importance of gas-surface interactions in the chemistry. The VPLO technique was also used to investigate a radical-surface reaction: the reaction of the CF3 radicals on a silicon oxide surface. The latter study revealed that H2O on the surface plays a major role in the chemistry. The surface reaction was studied as functions of surface temperature (320 to 530 K) and CF3 concentration. GRA

N86-23677# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SYNTHESIS OF ALPHA-OXIDES WITH A NITROGEN-CONTAINING SUBSTITUENT
N. A. Mukhitdinova 29 Oct. 1985 25 p Transl. into ENGLISH from the book "Sintez Novykh Monomerov" (USSR), 1973 p 78-95
(AD-A162055; FTD-ID(RS)T-0407-85) Avail: NTIS HC A02/MF A01 CSCL 07/2

A large number of works has been published on the obtaining of alpha-oxides with a N-containing substituent, but almost all of

them relate to the synthesis of epoxypropylamines. Only individual reports are known concerning the derivatives with the epoxyethyl radical. The structural formulas of the compounds are explained. The reactions of epichlorohydrin are studied and their structures listed in formulas. GRA

N86-23678# Science Applications International Corp., McLean, Va.
HIGH-TEMPERATURE THERMAL SIMULATOR: PHASE 1 Technical Report, 15 Aug. 1983 - 15 Sep. 1984
John A. Simmons and Michael D. McDonnell 28 Feb. 1985 114 p
(Contract DNA001-83-C-0224)
(AD-A162163; AD-E301844; SAIC-84/1715; DNA-TR-84-312) Avail: NTIS HC A06/MF A01 CSCL 20/13

This report describes the results of a study whose purpose was to determine how and to what extent the radiative output of DNA's Thermal Radiation Simulator (TRS) could be increased. Another purpose was to recommend a program for realizing that higher level of output. This study constituted the first phase of a program whose goals are to create a High Temperature Radiation Simulator (HTRS) producing: A radiative flux exceeding 160 cal/cm to the second power - sec and A radiation color temperature effectively greater than 4000 deg K. The study consisted of an examination of the pertinent literature and some theoretical analyses. The literature examined dealt primarily with the fundamental features of the combustion of metals with oxygen and the radiative and optical characteristics of metal-oxygen combustion products. The theoretical analyses focused on calculation of temperature and energy released from the combustion of various fuels with oxygen, estimation of radiation from a cloud of hot particulates, determination of the approximate relationships between radiative flux and flame height versus flame velocity, particle size and flame thickness, interpretation of combustion data to determine the burning rates of metal particles, and a qualitative analysis of the fluid dynamic and temperature structure of the present TRS's aluminum-oxygen flame. Based on the results, a set of techniques was defined which could lead to the attainment of the HTRS goals. Additionally, a program of experimental research was outlined to explore, develop and implement these techniques. GRA

N86-23679# Georgia Univ., Athens. Dept. of Chemistry.
TOPOLOGICAL INDICES AS CHEMICAL BEHAVIOR DESCRIPTORS
D. H. Rouvray 7 Nov. 1985 22 p
(Contract N00014-85-K-0365)
(AD-A162349; TR-8) Avail: NTIS HC A02/MF A01 CSCL 07/4

Graph theorists have contributed steadily to the development of chemistry but their contributions have been confined mainly to one or two applications. After briefly reviewing the principal applications of graph theory and combinatorics in chemistry, there are still numerous interesting mathematical problems waiting to be tackled. A number of these involve the various graph invariants used by chemists to characterize molecular graphs, usually referred to as topological indices (TIs). Many different TIs have been put forward to date and most have been employed to characterize chemical behavior dependent upon either: (1) molecular size, (2) molecular shape, and (3) specific molecular sites within a molecule. Three comparatively simple TIs based on the distance matrix are exhibited. The first of these has been used to predict the physicochemical properties of hydrocarbon molecules; the second, properties which depend on the degree of branching present in molecules (such as the octane number of fuels); and the third, the occurrence of carcinogencity, mutagenicity or tetratogencity in polycyclic aromatic species (polyhexes). GRA

N86-23680# Naval Research Lab., Washington, D. C.
PH DEPENDENT INTERACTIONS BETWEEN AQUEOUS IODIDE ION AND SELECTED OXIDIZERS
R. E. Pellenbarg 6 Dec. 1985 18 p
(AD-A162358; NRL-MR-5693) Avail: NTIS HC A02/MF A01 CSCL 07/2

Pseudo-first order rate constance for the reaction between the oxidizers peroxydisulfate, peroxide, percarbonate, and perborate ions and aqueous iodide have been measured pH 1, 4, 7, 9. Reactions were more rapid under acid conditions, and for the latter three test oxidizers, did not occur at all at pH 9. This fact has important implications for reactions to occur in seawater (pH about 8.3). Observed rate constants ranged from some .00065/sec (peroxydisulfate at pH 1), to no reaction at high pH for some anions. GRA

N86-23681# North Carolina Univ., Chapel Hill. Center for Stochastic Processes.
FLUCTUATIONS NEAR HOMOGENEOUS STATES OF CHEMICAL REACTIONS WITH DIFFUSION
Peter Kotelenez Nov. 1985 31 p
(Contract F49620-85-C-0144)
(AD-A162875; TR-126; AFOSR-85-1179TR) Avail: NTIS HC A03/MF A01 CSCL 07/4

Conditions are given under which a space-time jump Markov process describing the stochastic model of nonlinear chemical reactions with diffusion converges to the homogeneous state solution of the corresponding reaction-diffusion equation. The deviation is measured by a central limit theorem. This limit is a distribution valued Ornstein-Uhlenbeck process and can be represented as the mild solution of a certain stochastic partial differential equation. GRA

N86-23682# Department of the Navy, Washington, D. C.
CHEMICAL DETOXIFICATION OF POLYCHLORINATED BIPHENYLS (PCBS) Patent Application
Thomas Novinson, inventor (to Navy) Filed 4 Nov. 1985 9 p
(AD-D012072; US-Patent-Appl-SN-794928) Avail: NTIS HC A02/MF A01 CSCL 07/3

The present invention relates to the chemical detoxification of polychlorinated biphenyls by converting them to nonhazardous substances. In particular, the invention relates to chemically destroying polychlorinated biphenyls on site for decontamination purposes without creating pollution or hazardous situations. The invention provides a two-step process where polychlorinated biphenyls (PCBs), i.e., biphenyl having 2 to 10 chlorine atoms, are first reduced to unsubstituted biphenyl, then oxidized to a biodegradable dicarboxylic acid having the formula: (CH2)n (CO2H)2, where n=O to 10 possible -CH2- units for application in aqueous systems including water, mud and wet soil. GRA

N86-23683# Los Alamos National Lab., N. Mex.
MUTAGENICITY OF PHOTOCHEMICALLY-TRANSFORMED POLYCYCLIC AROMATIC AMINES
G. F. Strniste, J. W. Nickols, R. T. Okinaka, and T. W. Whaley 1985 22 p refs Presented at the Health and Environmental Research on Complex Organic Mixtures, Richland, Wash., 21 Oct. 1985
(Contract W-7405-eng-36)
(DE86-002394; LA-UR-85-3594; CONF-851027-3) Avail: NTIS HC A02/MF A01

Polycyclic aromatic amines (PAA) constitute a class of suspect genotoxic chemicals found in certain energy-related complex organic mixtures. A variety of studies is reported on the photochemical transformation (oxidation) of polycyclic aromatic amines and the increase in genotoxicity of the resulting complex mixtures of radiation-generated products. Biological endpoints of cytotoxicity and mutagenicity were measured in the Ames/Salmonella standard-plate assay. Chemical fractionation and identification of various photoproducts was accomplished with h.p.l.c., UV and IR spectroscopic and mass spectrometric techniques. The benchmark PAA in these studies was aminofluorene (2-AF). Photooxidation of 2-AF can occur at both the exocyclic nitrogen and certain ring positions resulting in the formation of direct-acting and potent bacterial mutagens, including 2-nitrosofluorene, 2-nitrofluorene, and 2-nitrofluoren-9-one. UVA-irradiated 2-AF solutions also contain promutagenic compounds, i.e., is 2-aminofluoren-9-one. These results support the hypothesis that the critical step in the activation of major, identified direct-acting mutagenic 2-AF photoproducts is their

reduction by bacterial nitroreductase enzymes to reactive hydroxylamines. DOE

N86-23684# General Electric Co., Schenectady, N. Y. Corporate Research and Development Dept.
DETECTION AND CHARACTERIZATION OF NOVEL METAL-BINDING PROTEINS First Year Report, 1984 - 1985
D. S. Holmes and R. D. Unterman Nov. 1985 21 p
(Contract DE-FG02-84ER-13278)
(DE86-003749; DOE/ER-13278/1) Avail: NTIS HC A02/MF A01

We have synthesized several model peptides based on the metallothionein (MT) protein sequence, and have used these, in conjunction with several naturally occurring proteins, to evaluate current methodologies for isolating and characterizing metal-binding proteins. Our off-contract research has indicated that High Pressure Liquid chromatography (HPLC) offers several distinct advantages compared to other techniques in this area. In addition, we have developed improved on-line analysis for the detection of sulfhydryl-containing proteins that have been separated by HPLC. DOE

N86-23685# Pacific Northwest Lab., Richland, Wash.
INVESTIGATION OF POTENTIAL ANALYTICAL METHODS FOR REDOX CONTROL OF THE VITRIFICATION PROCESS
D. S. Goldman Nov. 1985 41 p
(Contract DE-AC06-76RL-01830)
(DE86-003838; PNL-5581) Avail: NTIS HC A03/MF A01

An investigation was conducted to evaluate several analytical techniques to measure ferrous/ferric ratios in simulated and radioactive nuclear waste glasses for eventual redox control of the vitrification process. Redox control will minimize the melt foaming that occurs under highly oxidizing conditions and the metal precipitation that occurs under highly reducing conditions. The analytical method selected must have a rapid response for production problems with minimal complexity and analyst involvement. The wet-chemistry, Moessbauer spectroscopy, glass color analysis, and ion chromatography techniques were explored, with particular emphasis placed on the Moessbauer technique. In general, all of these methods can be used for nonradioactive samples. The Moessbauer method can readily analyze glasses containing uranium and thorium. A shielded container was designed and built to analyze fully radioactive glasses with the Moessbauer spectrometer in a hot cell environment. However, analyses conducted with radioactive waste glasses containing (90)Sr and (137)Cs were unsuccessful, presumably due to background radiation problems caused by the samples. The color of glass powder can be used to analyze the ferrous/ferric ratio for low chromium glasses, but this method may not be as precise as the others. Ion chromatography was only tested on nonradioactive glasses, but this technique appears to have the required precision due to its analysis of both Fe(+2) and Fe(+3) and its anticipated adaptability for radioactivity samples. This development would be similar to procedures already in use for shielded inductively coupled plasma emission (ICP) spectrometry. Development of the ion chromatography method is therefore recommended; conventional wet-chemistry is recommended as a backup procedure. DOE

N86-23686# Oak Ridge National Lab., Tenn.
PHYSICS DESIGN OPTIONS FOR COMPACT IGNITION EXPERIMENTS
N. A. Uckan 1985 50 p Presented at the U.S.-Japan Next Step Machine Design Workshop At JAERI, Mito, Japan, 21 Oct. 1985
(Contract DE-AC05-84OR-21400)
(DE86-003084; CONF-8510209-1) Avail: NTIS HC A03/MF A01

This paper considers the following topics: (1) physics assessments-design and engineering impact, (2) zero-dimensional confinement studies relating to physics requirements and options for ignited plasmas, classes of devices with equivalent performance, and sensitivity to variations in confinement models, and (3) one and one-half dimensional confinement studies relating to dynamic simulations, critical physics issues, startup analyses, and volt-second consumption. DOE

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N86-23687# Overseas Relations Branch Translation Service, London (England).
ELECTROLYTIC DEPOSITION OF LESS FREQUENTLY UTILIZED COATING METALS
A. Knoedler 30 Aug. 1985 7 p refs Transl. into ENGLISH from Jahrbuch der Oberflaechentech. (West Germany), v. 39, 1983 p 105-108
(BLL-OA-Trans-3249(6196.3)) Avail: British Library Lending Div., Boston Spa, Engl.

The properties of electrodeposited aluminum coatings, and the state-of-the-art in various countries are discussed. B.G.

N86-23688 Central Electricity Generating Board, London (England). Translation Section.
SOME PROPERTIES OF SIMULATED HEAT-AFFECTED ZONES IN Cr-Mo-V CAST STEEL
S. Asukura and M. Nihei [1985] 15 p refs Transl. into ENGLISH from Yosetsu Gakkaishi (Japan), v. 49, no. 2, 1980 p 143-148
(BLL-CE-Tr-8177-(9022.09-AC29)) Avail: British Library Lending Div., Boston Spa, Engl.

The notch ductility of the welding heat affected zone (HAZ) in low alloy steels like the Cr-Mo-V cast steel under test is sensitive to microstructural change in the course of cooling, and although the effect varies with the species and amount of alloying elements added, marked embrittlement occurs owing to increase in the amount of bainite if the preheating temperature used to prevent cracking is too high. Apart from cooling rate, the factors affecting notch ductiliy include the maximum heating temperature in the welding heat cycle, the various peak temperatures in a multiple heat cycle, the inter-pass temperature, and post heating conditions, the effects of which vary with the cooling time in the heat cycle. To clarify the relation between the above factors for the base metal under test, a continuous cooling transformation diagram (SH-CCT diagram) was constructed and the effect of various welding heat cycles and post heating conditions on impact strength, hardness and microstructure by means of heat cycle simulation tests was examined. In addition, the relation between notch ductility and cooling rate was investigated for actual and simulated heat affected zones. Author

N86-23689 British Library Lending Div., Boston Spa (England).
KINETIC DECAY OF SUPERHEATED SOLID SOLUTIONS
S. I. Sandrakov and V. V. Usatyuk 1985 4 p refs Transl. into ENGLISH from Izv. VUZ Chernaya Metallurgiya (USSR), no. 7, 1985 p 159
(BLL-M-36594-(5828.4)) Avail: British Library Lending Div., Boston Spa, England

A resistometric method, and metallography and X-ray spectrometry were used to study the process of decay of solid solutions of copper and silicon in aluminum during superheating to temperatures in the solidus/liquidus range. Author

N86-23690 British Library Lending Div., Boston Spa (England).
MECHANISM OF PERITACTIC-EUTECTIC REACTION IN Fe-C-Cr SYSTEM
Yu. N. Taran, L. M. Snagovskii, and E. Ya. Vasilev 1985 4 p Transl. into ENGLISH from Izv. VUZ Chernaya Metall. (USSR), no. 7, 1985 p 159-160
(BLL-M-36595-(5828.4)) Avail: British Library Lending Div., Boston Spa, Engl.

The peritectic-eutectic reaction in the Fe-C-Cr system was studied. The features of the occurrence and degree of completion of the reaction have an influence on the selection of the chemical composition of wear resistance in chromium pig iron. The methods of quenching from high temperature, differential thermal analysis, X-ray spectroscoy, and quantitative metallography were used. B.G.

N86-23691 British Library Lending Div., Boston Spa (England).
SURFACE HARDENING OF POLYCRYSTALLINE W-Zr-ALLOYS DURING INTERNAL SATURATION
M. Yu. Belomyttsev and B. G. Belyakov 1985 9 p refs Transl. into ENGLISH from Izv. VUZ Chernaya Metallurgiya (USSR), no. 7, 1985 p 126-129
(BLL-M-36588-(5828.4)) Avail: British Library Lending Div., Boston Spa, Engl.

The structure of the internal saturation zone in alloys of tungsten with 0.5 to 1.5% Zr after annealing in a nitrogen atmosphere and also the changes in surface microhardness were investigated. A diffusion layer up to 250 microns thick with a complex, three zone structure was formed. The observed increase in the hardness of the layer formed by internal saturation was the result of precipitation of fine ZrO2 and ZrN particles in the tungsten matrix. Author

N86-23692 Texas Univ., Austin.
THE ROLE OF STRESS-ASSISTED DIFFUSION IN HYDROGEN-ASSISTED SUSTAINED-LOAD CRACKING OF METALS Ph.D. Thesis
John Edward Hack 1985 232 p
Avail: Univ. Microfilms Order No. DA8529854

The tendency for solute atoms to redistribute due to a stress induced chemical potential gradient has long been accepted. Such redistribution in the hydrostatic stress field at the tip of a loaded crack has been proposed as the rate-controlling step in hydrogen-assisted sustained load cracking in inert atmospheres, where the bulk hydrogen content is too low to cause embrittlement if randomly distributed. Calculation of the kinetics and degree of the redistribution of hydrogen about a loaded crack tip has been hindered by the lack of a suitable crack tip stress field. In the present study, a closed-form crack tip hydrostatic stress field was developed based upon the approach of Barenblatt. The solution is unique in that the stresses are finite and continuous at all points. Although an analytical solution to the governing partial differential equation is not possible at this time, a numerical procedure was established which incorporates the desired stress field. Calculated concentration profiles at observed incubation times for cracking in iron and titanium alloys have been obtained. Dissert. Abstr.

N86-23693 Oklahoma State Univ., Stillwater.
ENVIRONMENTALLY INDUCED FRACTURE OF NICKEL ALLOYS: A COMPARISON OF HYDROGEN AND MERCURY EMBRITTLEMENT WITH RESPECT TO TEMPERATURE Ph.D. Thesis
Randall K. King 1985 154 p
Avail: Univ. Microfilms Order No. DA8528103

Environmentally assisted cracking is receiving more and more study as materials are pushed to new limits. Previous OSU studies have compared electrolytic hydrogen embrittlement (HE) and liquid metal embrittlement (LME) by mercury for numerous nickel alloys. All alloys tested exhibited embrittlement to some degree with HE and LME having similar fractographies. The effect of temperature on HE and LME of Monel 400 over the range -30 and 80 C is examined. Slow strain rate tensile tests were conducted at two strain rates and two grain sizes. Intergranular, transgranular, and microvoid coalescence fractures can be obtained in both hydrogen and mercury. Fracture mode is governed by strain at fracture. Embrittlement ceases below -20 C in both environments, believed due to lack of mobility of adsorbed hydrogen and lack of wetting by mercury. LME is more severe than HE because hydrogen blunts cracks by promoting plasticity. LME fractures remain brittle to 80 C. The existence of a temperature window for LME can be explained on the basis of strain-activated localized wetting. Results are consistent with a decohesion mechanism producing intergranular fracture. Dissert. Abstr.

N86-23694# AiResearch Mfg. Co., Torrance, Calif.
DEVELOPMENT OF A NITRIDE DISPERSION STRENGTHENED (NDS) METALLIC ALLOY FOR HIGH-TEMPERATURE RECUPERATORS Final Report, 1 Oct. 1982 - 30 Sep. 1984
L. E. Kindlimann Jun. 1985 129 p
(Contract DAAG29-82-C-0081; DA Proj. 1L1-62105-AH-84)
(AD-A161958; Rept-84-21418; AMMRC-TR-85-16) Avail: NTIS HC A07/MF A01 CSCL 11/6

The objective of this program was to demonstrate the feasibility of using nitride dispersion strengthened (NDS) stainless steel in fabricating a recuperator for advanced gas turbine engines. Test results showed an alloy--designated NDS 300--to have tensile properties comparable to those of Inconel 625 at temperatures up to 1650 F, and at higher temperatures the properties of the NDS alloy exceeded those of the Inconel 625. However, creep test results showed a three-fold improvement in strength of NDS 300 over Inconel 625 at temperatures above 1500 F. The NDS material demonstrated adequate formability and joinability by brazing with a filler metal of nominal composition Ni-19Cr-10Si (J8100). The same filler metal proved to be a good coating for high-temperature oxidation resistance. Tests on specimens prepared to a typical plate-fin recuperator configuration confirmed the strength of the brazing alloy and demonstrated the marked superiority of the NDS material over Inconel 625. GRA

N86-23695# Arizona State Univ., Tempe. Coll. of Engineering and Applied Sciences.
INVESTIGATION OF MATERIAL PROBLEMS FOR HIGH TEMPERATURE, HIGH POWER SPACE ENERGY-CONVERSION SYSTEMS Annual Progress Report, 1 May 1984 - 30 Apr. 1985
Dean L. Jacobson, James F. Morris, Mysore Ramalingam, Shlomo Snir, and Charles Bice 1985 272 p
(Grant AF-AFOSR-0067-83)
(AD-A162227; AFOSR-85-1026TR; APR-2) Avail: NTIS HC A12/MF A01 CSCL 11/6

Specific areas of research include investigations of methods of decreasing creep at the high temperatures encountered in the space environment; investigations for improving the properties of refractory metals, tungsten in particular, by alloy additions of rhenium, thoria and hafnium carbide; and development of emissivity data for materials of interest at elevated temperatures. The baseline system of tungsten, rhenium alloys is being researched to improve recrystallization characteristics, creep resistance etc. Impurity distributions and their deleterious phenomena are studied. Microalloying with thorium and hafnium is being evaluated because of their obvious influences on recrystallization; impurity segregation and embrittlement; solution, precipitation and embrittlement; solution, precipitation and dispersion strengthening; as well as other effects of their intensive gettering capabilities. The alloys are sintered and swaged into rods and wires for various high-temperature mechanical and electronic testing. Testing devices include: a high-temperature thermionic-emission microscope; a specially designed high-temperature vacuum tensile-testing machine; a specially designed and built zone refiner for possible refining conventional metallographic procedures; SEM, TEM and Auger surface analyses. GRA

N86-23696# Army Construction Engineering Research Lab., Champaign, Ill.
CORROSION PROTECTION FOR MILITARY CONSTRUCTION IN THE MIDDLE EAST Interim Report
V. Hock, V. Shea, R. Lampo, and J. R. Myers Sep. 1985 120 p
(AD-A162258; CERL-IR-M-85/16) Avail: NTIS HC A06/MF A01 CSCL 13/3

Preliminary information is given for corrosion mitigation techniques that can be applied to U.S. Army construction in the Middle East. The environment in these countries is unique--desert sands, high winds, and warm, salt-laden air from the surrounding sea--allowing even the most durable materials to corrode. The current Saudi Oriented Guide Specifications were utilized as a basis from which recommendations were made to extend facility lifetime through application of state-of-the-art corrosion mitigation techniques. GRA

N86-23697# Auburn Univ., Ala. Dept. of Mechanical Engineering.
ORDERED CARBON-METAL ALLOYS FOR EXTRATER-

RESTRIAL POWER SYSTEMS Annual Report, Jun. 1984 - Jun. 1985
Bryan A. Chin, N. H. Madsen, K. C. Yeh, and P. F. Gills 9 Aug. 1985 37 p
(Grant AF-AFOSR-0168-83)
(AD-A162287; AFOSR-85-1041TR) Avail: NTIS HC A03/MF A01 CSCL 11/6

The objective of this research is to investigate a new class of material composed of 30 to 60 atomic percent (C-Ti) for ultrahigh temperature applications in space power systems. The alloy system under investigation exhibits melting temperatures in excess of 2500 C and form long range ordered structures which are expected to yield materials with exceptional high temperature strength and resistance to environmental degradation. Author (GRA)

N86-23698# Rhode Island Univ., Kingston. Chemical Lab.
ROLE OF INTERFACES IN DEFORMATION AND STRENGTHENING Final Report, 5-9 Aug. 1985
William D. Nix and Alexander M. Cruickshank 30 Sep. 1985 21 p
(Grant AF-AFOSR-0219-85)
(AD-A162289; AFOSR-85-1035TR) Avail: NTIS HC A02/MF A01 CSCL 11/6

The primary purpose of the conference concerned the mechanical properties of finely structured materials with interest in the structure and properties of interfaces. Many of the participants indicated that they had developed new ideas which they intended to pursue in the coming months. GRA

N86-23699# Columbia Univ., New York. Center for Strategic Materials.
UNDERSTANDING THE HIP (HOT ISOSTATIC PRESSING) CONSOLIDATION OF P/M NICKEL-BASE SUPERALLOYS Annual Progress Report, 1 Oct. 1982 - 30 Sep. 1983
John K. Tien 19 Jun. 1985 15 p
(Grant AF-AFOSR-0352-82)
(AD-A162387; AFOSR-85-0984TR) Avail: NTIS HC A02/MF A01 CSCL 11/6

Superalloy powders have been completely characterized. The different size distributions of powders have been containerized and are ready for HIP at the commercial condition of pressure and temperature, which is 15 ksi at 2050 degrees F. All creep specimens are machined and creep tests are now under way (two creep runs have already been completed). Framework for the new HIP model has been developed in order to include unequal particle sizes. GRA

N86-23700# Cornell Univ., Ithaca, N.Y. Materials Science Center.
STRUCTURE-INDUCED SURFACE VIBRATIONAL RESONANCES ON METAL SURFACES Interim Report
M. Persson, J. A. Stroscio, and W. Ho Dec. 1985 11 p
(Contracts N00014-81-K-0505; N00014-82-K-0576)
(AD-A162820; TR-17) Avail: NTIS HC A02/MF A01 CSCL 11/6

A new class of surface vibrational resonances are shown to exist on surfaces having a non-monotonic bulk phonon dispersion as the result of their particular geometric structure. These resonances have previously been observed by electron energy loss spectroscopy on the (110) surfaces of Cu and Ni, and analysis based on surface lattice dynamics of measurements on the Al(110) and the Fe(111) surfaces are now reported. The resonance is observed on Fe but not on Al. GRA

N86-23701# Army Armament Research and Development Command, Watervliet, N. Y. Large Caliber Weapon Systems Lab.
CRACK GROWTH BEHAVIOR OF ALUMINUM ALLOYS TESTED IN LIQUID MERCURY Final Technical Report
J. A. Kapp, D. J. Duquette, and M. H. Kamdar Sep. 1985 39 p Presented at ASME Symposium, Crack Growth Behavior of Material Susceptible to Stress Corrosion, Dec. 1984, New Orleans, La.
(AD-A162852; AD-E440309; ARLCB-TR-85034) Avail: NTIS HC A03/MF A01 CSCL 11/6

Crack growth rate measurements have been made in three mercury embrittled aluminum alloys each under three loading conditions. The alloys were 1100-0, 6061-T651, and 7075-T651. The loading conditions were fixed displacement static loading, fixed load static loading, and fatigue loading at two frequencies. The results showed that mercury cracking of aluminum was not unlike other types of embrittlement (i.e., hydrogen cracking of steels). Under fixed load static conditions no crack growth was observed below a threshold stress intensity factor (KILME). At K levels greater that KILME cracks grew on the order of cm/s, while under fixed displacement loading, the crack growth rate was strongly dependent upon the strength of the alloy tested. This was attributed to crack closure. In the fatigue tests, no enhanced crack growth occurred until a critical range of stress intensity factor (Kth) was achieved. The Kth agreed well with the KILME obtained from the static tests, but the magnitude of the fatigue growth rate was substantially less than was expected based on the static loading results. Observations of the fracture surfaces in the scanning electron microscope (SEM) suggested a brittle intergranular fracture mode for the 6061-T651 and the 7075-T651 alloys under all loading conditions. The fractographic features of the 1100-0 alloy under fixed load and fatigue loading conditions were also brittle intergranular. Under fixed displacement loading the cracks grew via a ductile intergranular mode. GRA

N86-23702# Florida Univ., Gainesville. Dept. of Materials Sciences and Engineering.
GRAIN REFINING AND MICROSTRUCTURAL MODIFICATION DURING SOLIDIFICATION Annual Report, Sep. 1984 - 31 Aug. 1985
G. J. Abbaschian, J. A. Patchett, R. Russell, S. P. Abeln, and R. Schmees 25 Oct. 1985 101 p
(Contract N00014-81-K-0730)
(AD-A162866; AR-4) Avail: NTIS HC A06/MF A01 CSCL 11/6

This report summarizes progress during the 1984 to 1985 fiscal year of a research program to study grain refining and microstructural modification during solidification, as affected by supercooling, solidification rate and/or innoculation. The report covers results of the current investigations on the kinetics of peritectic reactions during solidification of binary Al-Ni alloys, and high temperature phase transformations in binary Cr-Ni alloys. In addition, the report contains results of three other completed projects related to grain refining in Cu-Fe alloys, thermomechanical processing of rapidly solidified Al-Li-Mg-Zr alloy powder, and purification of Nb by electromagnetic levitation melting.
Author (GRA)

N86-23703# Battelle Columbus Labs., Ohio.
MECHANICS ASPECTS OF MICROCRACK GROWTH IN INCONEL 718-IMPLICATIONS FOR ENGINE RETIREMENT FOR CAUSE ANALYSIS Final Report, 1 Jul. 1982 - 1 Jan. 1984
B. N. Leis, D. P. Goetz, J. Ahmad, A. T. Hopper, and M. F. Kanninen 18 Mar. 1985 166 p
(Contract F33615-81-C-5051)
(AD-A162886; AFWAL-TR-84-4041) Avail: NTIS HC A08/MF A01 CSCL 11/6

Fatigue crack-growth rate predictions based on linear elastic fracture mechanics have been successfully applied in damage tolerance analyses for many years. These successes have prompted the Air Force Wright Aeronautical Laboratories to undertake the research needed to develop the technology to track the growth of defects in engine components. This application is not trivial because there is a growing body of experimental data that indicate that linear elastic fracture mechanics concepts do not always consolidate crack-growth-rate data. The lack of consolidation is particularly acute for physically short cracks and often the trend is toward much higher crack growth rates than expected. A literature review led to the conclusion that this short-crack effect arose primarily because of crack tip plasticity, transients from initiation to microcracking, and incorrect or incomplete implementation of LEFM. However, the data did not discriminate between these possible causes to that it was not clear which were significant. An experimental program was

undertaken to isolate or emphasize the factors thought to promote the short-crack effect. The material used in the study was Inconel 718 in a heat-treatment condition found in current advanced engines. This report presents the results of those experiments. GRA

N86-23704# California Univ., Berkeley. Lawrence Berkeley Lab.
NEW, COLD FORMABLE Fe/Al/C DUAL PHASE STEELS
G. Thomas Aug. 1985 29 p Presented at the Chinese Society for Metals Conference, Beijing, China, 4 Nov. 1985
(Contract DE-AC03-76SF-00098)
(DE86-001996; LBL-20142; CONF-8511109-1) Avail: NTIS HC A03/MF A01

Alloy design programs in dual phase low carbon steels have adopted their physical metallurgy to batch plant processing conditions. The alloys are based on ferritic-martensitic low carbon steels containing aluminum, but without manganese or microalloying elements. The two-phase mixture rule provides a fairly good approximation of the mechanical behavior of these duplex systems, but it has been recognized that the properties of both the ferrite and martensite depend on the volume fraction of martensite produced in the final morphology. Thus ferrite strengthening can be effected by precipitation hardening, and the strength of martensite may increase due to carbon enrichment as its volume fraction is decreased. Utilization of both of these factors results in a composite whose properties do not depend very much upon the martensite volume fraction (up to about 0.4). This allows greater flexibility in heat treatment, and thus suggests that dual phase steel can be produced by batch processing without requiring strict temperature control to achieve consistent properties. DOE

N86-23705# Brookhaven National Lab., Upton, N. Y.
ALUMINUM AND BORON PHOSPHATES AS POSSIBLE PROTON CONDUCTORS
E. Montoneri, F. J. Salzano, and L. Giuffre May 1985 19 p Presented at the 4th IEA Task Workshop on Electrolytic Hydrogen Production, Julich, West Germany, 14 Jul. 1985
(Contract DE-AC02-76CH-00016)
(DE86-002508; BNL-36682; CONF-850799-2) Avail: NTIS HC A02/MF A01

The chemical stability and conductivity of boron and aluminum phosphates in steam are reported for P/B and P/Al atomic ratios greater than unity at temperatures from 100(0) to 280(0)C and steam pressures to 5 atmospheres. Al(PO3)3 and H2 AlP3O10 undergo the reactions Al (PO3)3 + H2) in equilibrium H2AlP3O10 and H2AlP3O10 (YIELDS) AlPO4 + H2O.P2O5(g). At 280(0)C and a steam pressure of 5 atmospheres gauge the product is mixture of AlPO4 and H2AlP3O10, while the conductivity of this solid is in the range of 10(-2) ohm(-1) cm(-1). The boron phosphates lose material and exhibit poor conductivity under similar conditions due to the instability of the BPO4 phase as a result of the reaction 2BPO4 + 6 H2O (YIELDS) B2O3.3H2O(g) + P2O5. 3H2O(g). As a result of dehydration or hydrolytic reactions an increase in water vapor pressure does not always lead to increased conductivity even at higher temperature. DOE

N86-23706# California Univ., Berkeley. Lawrence Berkeley Lab.
MAGNETO-MECHANICAL EFFECTS IN TWO STEELS WITH METASTABLE AUSTENITE
B. Fultz, G. O. Fior, G. M. Chang, R. Kopa, and J. W. Morris, Jr. Mar. 1985 15 p Presented at the Cryogenic Engineering Conference and International Cryogenic Materials Conference, Boston, Mass., 12 Aug. 1985
(Contract DE-AC03-76SF-00098)
(DE86-002865; LBL-19233; CONF-850814-29) Avail: NTIS HC A02/MF A01

Magneto-mechanical effects, or effects of magnetic fields on mechanical propeties of materials, are reported for two steels containing austenite that undergoes an fcc(YIELDS)bcc martensitic transformation during plastic deformation. Stress-strain curves from tensile tests of AISI 304 stainless steels and 9Ni steels were measured in magnetic fields as large as 18 T at temperatures of 4(0)K, 77(0)K and room temperature. Even in 18 T magnetic fields at cryogenic temperatures the magneto-mechanical effects were small, but they were reproducible and scaled with the strength of the magnetic field and the amount of transformation. Magneto-mechanical effects in steels with metastable austenite provide a unique means of determining how martensitic transformations affect mechanical behavior. The fcc(YIELDS)bcc transformation makes an important contribution to the work hardening of both AISI 304 and 9Ni steel, so the more rapid transformation during magnetic exposure results in a higher strength and a reduced elongation of tensile specimens. In AISI 304 stainless steel a reduced flow stress in the magnetic field was found at small plastic strains. DOE

N86-23707# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho.
MICROSTRUCTURAL CHARACTERIZATION OF RAPIDLY SOLIDIFIED TYPE 304 STAINLESS STEEL
R. N. Wright, J. E. Flinn, and G. E. Korth Nov. 1985 12 p Presented at the Materials Research Society Meeting, Boston, Mass., 2 Dec. 1985
(Contract DE-AC07-76ID-01570)
(DE86-003245; EGG-M-11985; CONF-851217-3) Avail: NTIS HC A02/MF A01

The microstructures of rapidly solidified Type 304 stainless steel powders produced by vacuum gas (VGA) and centrifugal (CA) atomization have been examined. The solidification morphology and phase distribution have been characterized using optical and scanning electron microscopy, and the relative amounts of ferrite and austenite have been quantified using X-ray diffraction. It has been found that most CA powder particles contain both fcc and bcc phases, with the bcc phase predominating at small particle sizes and the fcc phase at large particle sizes. The VGA powder generally contains less ferrite, with very little dependence on the particle size. In both powders the ferrite was found to be metastable and to transform to austenite on annealing at 900C. DOE

N86-23708# Oak Ridge National Lab., Tenn.
GRAIN BOUNDARY SLIDING IN WIRES WITH BAMBOO STRUCTURE
J. H. Schneibel and G. F. Petersen 1985 8 p Presented at the 4th Japan Institute of Metals International Symposium (JIMIS-4) on Grain Boundary Structure and Related Phenomena, Minakami Spa, Japan, 25 Nov. 1985
(Contract DE-AC05-84OR-21400)
(DE86-002225; CONF-8511128-1) Avail: NTIS HC A02/MF A01

Grain boundary sliding during the torsional creep deformation of austenitic stainless steel wires (Fe-15 wt % Cr-15 wt % Ni) with bamboo structures has been investigated. At 1100(0)K, the sliding rate du/dt is approximately proportional to tau/sup 2.5/ where tau is the applied shear stress. Although Reading and Smith's [Phil. Mag. A, 51, 71 (1985)] model of lattice-dislocation grain boundary sliding has shortcomings, it predicts the observed sliding rates quite well. At sufficiently small grain sizes and low stresses, the observed nonlinear grain boundary sliding may inhibit diffusional creep. DOE

N86-23709# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho.
NUMERICAL CALCULATIONS OF ULTRASONIC FIELD/CRACK INTERACTIONS
J. A. Johnson and D. M. Tow 1985 8 p Presented at the Review of Progress in Quantitative NDE, Williamsburg, Va., 23 Jun. 1985
(Contract DE-AC07-76ID-01570)
(DE86-003230; EGG-M-09385; CONF-8506110-6) Avail: NTIS HC A02/MF A01

A program for calculating realistic ultrasonic fields in solids has been shown to be in good agreement with the model of Thompson and Gray. The program was used in combination with some simple field/flaw interaction models to predict the spectra of the returning echoes from the flaws, and these spectra have been compared to experimental measurements, with fair agreement for the best model. However, some details of the spectra have

only been partially reproduced, indicating that some improvement in the field/flaw interaction models is required. DOE

N86-23710# Bell Telephone Labs., Inc., Holmdel, N. J.
EARLY STAGES OF REACTION BETWEEN AMORPHOUS Ni-Nb AND CRYSTALLINE Au FILMS
E. A. Dobisz, H. G. Craighead, J. H. Perepezko, J. D. Wiley, B. L. Doyle, and P. S. Peercy 1985 11 p Presented at the Materials Research Society Meeting, Boston, Mass., 2 Dec. 1985 Prepared in cooperation with Wisconsin Univ., Madison and Sandia National Labs., Albuquerque, N. Mex.
(Contract DE-AC04-76DP-00789)
(DE86-003723; SAND-85-2619C; CONF-851217-10) Avail: NTIS HC A02/MF A01

Thin film interactions between a-(Ni-Nb) and polycrystalline Au overlayers were studied with high depth resolution (less than or equal to 17A) Rutherford backscattering (RBS) and TEM to obtain information on the early stages of reactions at the interface. The RBS spectra from Au indicated that the interdiffused samples consisted of two layers: an Au-Nb binary layer on the surface and a ternary Au-Ni-Nb compound layer beneath the binary layer. This growth kinetics of the ternary compound later differed for unrelated samples and samples which had been relaxed prior to Au deposition. Cross-section TEM showed that relaxed and unrelaxed samples exhibit different microstructures. The result indicates that the reaction stages in the relaxed samples are less advanced than those in the unrelaxed samples. DOE

N86-23711# Mound Lab., Miamisburg, Ohio.
PULSED LASER WELDABILITY OF ALUMINUM ALLOYS
L. A. Weeter 1985 9 p Presented at the ICALEO International Congress on the Applications of Lasers and Electro-optics, San Francisco, Calif., 11 Nov. 1985
(Contract DE-AC04-76DP-00053)
(DE86-003731; MLM-3320(OP); CONF-8511103-4) Avail: NTIS HC A02/MF A01

This study was undertaken to determine the weldability of six aluminum alloys (1100, 3003, 4043, 4047, 5356, and 6061) in similar alloy, dissimilar alloy, and similar alloy with a 4047 filler metal addition combinations. The Pulsed Laser Weldability Test was used to evaluate the weldability of the various alloy combinations. The Pulsed Laser Weldability Test rated the weldability of the six aluminum alloys from least crack sensitive to most crack sensitive as: 1100, 4047, 4043, 3003, 5356, 6061. The results of joining 1100, 3003, 5356, or 6061 to either 4043 or 4047 in an approximately 50% mixture revealed that all of these combinations were very crack sensitive. The addition of smaller amounts of 4047 to either 5356 or 6061 revealed the same phenomenon. 0.08, 0.13, and 0.25 millimeter thick sheets of 4047 were placed between two pieces of either 5356 or 6061 and the weldability test was performed. All of the filler metal additions made crack sensitive joints. A 0.38 mm thick sheet of 4047 was also tested between 5356 or 6061. However, this sheet was too thick for the Pulsed Laser Weldability Test for accurate evaluation. DOE

N86-23712# Hanford Engineering Development Lab., Richland, Wash.
NEW DEVELOPMENTS IN IRRADIATION-INDUCED MICROSTRUCTURAL EVOLUTION OF AUSTENITIC ALLOYS AND THEIR CONSEQUENCES ON MECHANICAL PROPERTIES
F. A. Garner, H. R. Brager, M. L. Hamilton, R. A. Dodd, and D. L. Porter 1985 29 p refs Presented at the Workshop on the Relation Between Mechanical Properties and Micro-structure Under Fusion Irradiation Conditions, Ebeltoft, Denmark, 27 Jun. 1985
(Contract DE-AC06-76FF-02170)
(DE86-004016; HEDL-SA-3353; CONF-8506165-4) Avail: NTIS HC A03/MF A01

A survey is presented of recent development in the study of radiation-induced changes in the microstructure of austenitic structural alloys that occur in fission reactors. The associated macroscopic consequences of these changes on both mechanical properties and dimensional stability are also reviewed. It is anticipated that some changes will occur in these phenomena as a result of the differences inherent in fission and fusion neutron spectra, but relevant data obtained to date do not indicate that the effects of helium and several other transmutation-related changes will be large. DOE

N86-23713# California Univ., Berkeley. Lawrence Berkeley Lab.
CHEMICAL AND OPTICAL PROPERTIES OF ELECTROCHROMIC NICKEL OXIDE FILMS
C. M. Lampert, T. R. Omstead, and P. C. Yu Aug. 1985 9 p Presented at the SPIE International Technical Symposium on Optical and Electro-optical Engineers, San Diego, Calif., 18 Aug. 1985
(Contract DE-AC03-76SF-00098)
(DE86-003997; LBL-20211; CONF-850887-42) Avail: NTIS HC A02/MF A01

Thin films of nickel oxide-nickel hydroxide are investigated to determine electrochromic switching properties. Crystalline nickel oxide films are synthesized by electrochemical deposition and by anodization of nickel electrodes. Electrochemical deposition using nickel sulfate-based chemistry is used to deposit films directly on doped tin oxide-coated glass. Spectral solar transmittance is obtained for films switched in liquid cells containing a KOH electrolyte. The solar transmittance (T sub s) can be switched from T sub s (bleached) = 0.73 to T sub s (colored) = 0.35 for films with thickness of about 500 A. Voltammetric data is correlated to known electrochemical processes for nickel electrodes. The nickel oxide films are chemically analyzed using a sputter-Auger microprobe and X-ray photoelectron spectroscopy. As a result of combined analysis, it was determined that these films transform from uncolored to colored states by the reversible transformation of nickel hydroxide Ni(OH)2 to nickel oxyhydroxide NiOOH and that dehydrated films correspond chemically to NiO. DOE

N86-23714# Messerschmitt-Boelkow-Blohm G.m.b.H., Bremen (West Germany).
COMPARISON OF ALUMINUM ALLOYS CONCERNING STRENGTH AND DAMAGE TOLERANCE
Lueder Schwarmann 21 Aug. 1985 21 p refs
(MBB-UT-111/85; Rept-TE-374/0723/85) Avail: NTIS HC A02/MF A01

The static strength, crack growth, and residual strength of high strength aluminum alloys used in aircraft engineering were investigated using approved material data. Alloys having high static strengths show worse crack growth and residual strength behavior compared with alloys having lower static strengths. The 2024-materials show the best crack growth behavior. The 7475-materials show the best residual strength behavior. Heat-treatment influences the crack growth and strength behavior significantly. Product form does not influence crack growth and strength behavior. The casting material A 357 T6 shows nearly the same crack growth behavior as the plate material 2024-T351, but shows worse strength behavior as compared with all other materials considered.
Author (ESA)

N86-23715# General Electric Co., Schenectady, N. Y. Materials Information Services.
STANDARDS AND METADATA REQUIREMENTS FOR COMPUTERIZATION OF SELECTED MECHANICAL PROPERTIES OF METALLIC MATERIALS Final Report
J. H. Westbrook Aug. 1985 50 p Sponsored in part by National Bureau of Standards, Gaithersburg, Md. and Army Materiel Development and Readiness Command, Alexandria, Va.
(PB86-129558; NBS/SP-702; LC-85-600585) Avail: NTIS HC A03/MF A01; also available SOD HC $2.00 as 003-003-02691-3 CSCL 11F

To assist in building a computerized information system on the engineering properties of materials, the standards and metadata requirements for a representative group of mechanical property categories are considered. These categories include: tensile behavior, hardness numbers, notch-bar impact test parameters and fatigue properties. For each property group, definitions of terms, synonyms (and non-synonyms), standard test methods, standards for reporting data, precision and accuracy, and correlations of

properties are addressed. The principal findings and recommendations are as follows. Existing test methods are generally adequate for the properties considered but better standards are needed for data reporting. Appraisal of materials variability and testing machine variability would be assisted by access to standard reference materials, certified as to their mechanical properties. GRA

N86-23716# Bureau of Mines, Avondale, Md.
SEPARATION OF CAST AND WROUGHT ALUMINUM ALLOYS BY THERMOMECHANICAL PROCESSING Report of Investigations, 1985
R. D. Brown, F. Ambrose, and D. Montagna 1985 21 p refs
(PB86-107885; BM-RI-8960; LC-85-600020) Avail: NTIS HC A02/MF A01 CSCL 11F

Techniques exist for separating aluminum alloys from mixed scrap, but there are no efficient ways to separate wrought aluminum from cast aluminum. A novel technique for separating mixed aluminum alloy scrap into cast and wrought aluminum alloy fractions is described. The technique, which uses conventional heating, fragmentizing, and screening equipment, exploits differences in the mechanical properties of cast and wrought aluminum alloys at elevated temperatures. GRA

N86-23717# United Kingdom Atomic Energy Authority, Harwell (England). Materials Physics and Metallurgy Div.
THE EFFECT OF LONG TERM THERMAL AGEING ON THE MECHANICAL PROPERTIES OF ASTM A533B AND A508 STEELS IN THE QUENCHED AND TEMPERED AND SIMULATED HEAT AFFECTED ZONE CONDITIONS
S. G. Druce, G. Gage, and G. Jordan Apr. 1985 43 p refs
(AERE-R-11459) Copyright. Avail: Issuing Activity

Manganese-molybdenum-nickel steels are used commonly in the fabrication of critical components in the PWR primary circuit operating at temperatures up to 345 C for periods up to several hundred thousand hours. Demonstration of structural integrity throughout service life requires quantification of the effects of thermal ageing on mechanical properties. Thermal ageing in the temperature range 300 to 550 C for durations up to 2000 h was studied in quenched and tempered A533B plate and simulated heat-affected-zone (HAZ) microstructures in A533B and A508 materials. A combination of tensile, hardness and Charpy impact tests were used to assess changes in rheological and toughness related properties. Quantitative fractography and Auger spectroscopy were used to characterize associated changes in fracture mode and grain boundary composition. Author

N86-23718# United Kingdom Atomic Energy Authority, Harwell (England). Materials Development Div.
INTERACTIONS OF FECRALLOY STEEL WITH SODIUM DISILICATE GLASS
M. G. Nicholas Sep. 1985 18 p refs
(AERE-R-11923) Copyright. Avail: Issuing Activity

Interactions of sodium disilicate glass with Fecralloy steel were analyzed in terms of the Pask chemical equilibrium theory. Sessile drops assumed contact angles of 38 to 47 degrees at 900 to 1100 C on polished substrates following interactions that led to significant weight losses. Up to 7% of aluminum and much smaller amounts of iron, chromium manganese and yttrium were taken into the glass. On preoxidized substrates, coated with alumina, near perfect wetting was achieved but once more aluminum was taken into the glass and weight losses suffered. These data can be interpreted as resulting from redox reactions between the aluminum in the alloy and the sodium monoxide in the glass. Author

N86-23719# United Kingdom Atomic Energy Authority, Harwell (England). Materials Development Div.
SOME CHARACTERISTICS OF THE INITIATION PHASE OF PITTING CORROSION OF STAINLESS STEEL
D. E. Williams, M. Fleischmann, J. Stewart, and T. Brooks Aug. 1985 20 p refs
(AERE-M-3492) Copyright. Avail: Issuing Activity

For type 304L stainless steel in dilute aqueous NaCl solution (0.028M, 1000 ppm chloride), current pulses attributable to the occurrence of pits which initiate, grow for a while, and then die, are observable at potentials well cathodic to the so-called repassivation potential. The distribution of intervals between events was exponential, so the events themselves were randomly distributed in time. The event frequency depended upon electrode pontential; the dependence could be used to describe a threshold potential for pit initiation such that the probability of observing a pitting event was arbitrarily small at potentials cathodic to the threshold potential. The event frequency was sensitive to the presence of contaminants that had been leached from the apparatus. The event frequency did not seem to depend strongly upon the solution flow rate, for flow in both laminar and turbulent regimes. The event lifetimes were approximately exponentially distributed, corresponding to a fixed probability of death of an event. The lifetime distribution seems to be independent of electrode potential, and of solution flow in the laminar regime. Under turbulent flow conditions, the propagation of events, which had passed from the unstable into the stable pitting phase, was inhibited, and sometimes stopped. Author

N86-23720# United Kingdom Atomic Energy Authority, Harwell (England). Nuclear Physics Div.
A COMPARISON BETWEEN SURFACE TREATMENTS FOR METALLURGICAL APPLICATIONS
P. D. Goode Apr. 1985 42 p refs
(AERE-R-11643) Copyright. Avail: Issuing Activity

A number of surface treatments, excluding coating methods are briefly described to highlight their main features. Recent techniques and their advantages and disadvantages over the more conventional methods are considered. The aim is to provide guidance in the selection of techniques for particular applications. Author

N86-23776# Joint Publications Research Service, Arlington, Va.
DEVELOPMENT, USES OF NEW METAL MATERIALS EXAMINED
J. Tada *In its* Japan Report: Science and Technology (JPRS-JST-86-007) 25 Mar. 1986 p 18-40 Transl. into ENGLISH from Nikko Materials (Tokyo, Japan), Aug. 1985 p 89-100 (For primary document see N86-23773 14-31)
Avail: NTIS HC A04/MF A01

N86-24510*# Alabama Univ., Birmingham. Dept. of Materials Engineering.
THE EFFECT OF GROWTH RATE ON THE COMPOSITIONAL VARIATIONS IN DIRECTIONALLY SOLIDIFIED Hg(1-x) CdSUBxSe
Rosalia N. Andrews *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 39 p refs (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 11F

N86-24531*# Auburn Research Foundation, Inc., Ala. Dept. of Mechanical and Materials Engineering.
ON THE DETERMINATION OF THE ORIGIN OF LINEAR ANOMALY IN THE MACROSTRUCTURE OF VPPA WELDED 2219-T87 ALUMINUM ALLOY
Wartan A. Jemian *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 30 p refs (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 11F

N86-24532*# Huntingdon Coll., Montgomery, Ala. Dept. of Chemistry.
ELECTROCHEMICAL CORROSION STUDIES
Ward W. Knockemus *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 19 p refs (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 11F

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N86-23721 Akron Univ., Ohio.
THE EFFECT OF STEREOCHEMICAL STRUCTURE ON SOME SPECTROSCOPIC AND PHYSICAL PROPERTIES OF POLYSTYRENE Ph.D. Thesis
Arijit M. Dasgupta 1986 243 p
Avail: Univ. Microfilms Order No. DA85269525

Isotactic polystyrene was epimerized to different extents to obtain a series of polymers with varied stereochemical compositions, the structures of which were calculated by a Monte-Carlo simulation of the epimerization process. An investigation was carried out on the 300 and 400-MHz 1H-NMR spectra of the isotactic, epimerized polymers and atactic polystyrene as well as their acetylated derivatives. An interpretation was consequently developed for the methine proton resonance in terms of pentad stereosequences as well as for the ortho aromatic proton resonance of polystyrene. A procedure was also developed for the preparation of arylsufonyl derivatives of polystyrene. The polymers were characterized by physical and spectroscopic methods. The FTIR spectra of the polystyrene samples were also investigated in order to attempt a quantitative interpretation of the changes in intensity of stereo-sequence-sensitive bands in terms of sequence distributions. A good correlation was obtained between FTIR and Monte-Carlo simulation results. Thermal properties of the polystyrene samples were determined. Dissert. Abstr.

N86-23722 Texas Univ., Austin.
DYNAMIC COMPRESSIBILITY OF HIGH POLYMERS Ph.D. Thesis
Tien-Sheng Lin 1985 99 p
Avail: Univ. Microfilms Order No. DA8529879

The combined effects of molecular weight, temperature, frequency, and pressure on the complex dynamic compressibility of several high polymers were investigated. A computer controlled apparatus was used, in which the polymer sample was subjected to sinusoidal pressure variation in a chamber small compared to the acoustic wavelength, with provisions for controlling frequency, temperature and hydrostatic pressure. Measurements were done from 0 to 56 C in the frequency range 0.25 to 1.0 kHz, at pressures of 12 and 81 atm. The polymers studied were polyvinyl acetate of three different molecular weights, polymethyl methacrylate (PMMA) of two different molecular weights, and TEFLON. The molecular weight dependence of the compressibility of polyvinyl acetate was examined here for the first time. It is found that the magnitude of this effect can be predicted from relationships, already in the literature, giving the dependence of the glass-point temperature on molecular weight. The combined effects of temperature and frequency on loss peak indicate that the limiting temperature sensitive process in the viscoelastic behavior of polyvinyl acetate is the same for shear deformation and for compression.
Dissert. Abstr.

N86-23723# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.
ACETYLENE TERMINATED SULFONE RESIN PRECURSORS OF TAILORED LENGTH VIA A MODIFIED ULLMANN ETHER SYNTHESIS Final Report, Apr. 1981 - Aug. 1982
Marilyn R. Unroe and Frederick L. Hedberg May 1985 44 p
(AF Proj. 2419)
(AD-A161859; AFWAL-TR-85-4040) Avail: NTIS
HC A03/MF A01 CSCL 11/9

Air Force sponsored research in recent years has been directed toward the discovery and development of new composite resins which would display all of the advantages of epoxy resins, but without the moisture sensitivity problem. One of the first resins to show such potential was the AT resin, 4,4'-bis(3-ethynylphenoxy)-phenylsulfone (ATS). Its initial limitation, however, was very high cost. As a result, of contractual research for the Air Force at Gulf Research and Development Company, a new, low cost synthesis approach to ATS was developed. the Ullmann ether reaction of 4,4'-sulfonyl with 1,3-dibromobenzene was carried out in 2,4,6-collidine with cuprous oxide to afford high yields of a mixture of 4,4'-bis(3-bromophenoxy)phenylsulfone (BPDS) and its associated oligomers (OBPDS). This mixture is a low-cost precursor to the ATS composite resin system, formed by replacing the bromine atoms by terminal acetylene groups. The ratio of BPDS to OBPDS was found to be tailorable by varying stoichiometry, permitting selection of average ATS oligomer length for desired balances between processing and mechanical properties. GRA

N86-23724# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.
IODINE MONOCHLORIDE AS A REAGENT FOR THE PREPARATION OF HETEROCYCLIC POLYMER PRECURSORS-UTILITY AND LIMITATIONS Final Report, Sep. 1980 - Sep. 1982
Patricia M. Lindley, Alan A. Shaffer, and Frederick L. Hedberg May 1985 11 p
(AF Proj. 2419)
(AD-A161860; AFWAL-TR-85-4039) Avail: NTIS
HC A02/MF A01 CSCL 07/2

Whereas iodine monochloride reacted with o-nitroaniline or p-nitroaniline to afford iodine substituted products useful for aromatic coupling or functional group introduction, the reaction of iodine monochloride with amide derivatives of o-phenylenediamine afforded predominantly chlorination. The scope of the reaction was investigated varying both substituted phenylenediamine amide substrate and solvents. Author (GRA)

N86-23725# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
IMPROVED SYNTHESIS OF BENZIL END-CAPPED ACETYLENE TERMINATED PHENYLQUINOXALINE RESINS Final Technical Report, Jun. 1980 - Aug. 1982
Frederick L. Hedberg, Patricia M. Lindley, and Marilyn E. Hunsaker May 1985 15 p
(AD-A161881; AFWAL-TR-85-4042) Avail: NTIS
HC A02/MF A01 CSCL 11/9

The synthesis of two acetylene-terminated phenylquinoxaline resin systems: BA-DAB-BA, derived from 4-(3-ethynylphenoxy) benzil, 3,3'-diaminobenzidine; and BATQ-H, derived from 4-(3-ethynylphenoxy)benzil, 3,3'-diaminobenzidine, and 1,4-bis(4-benziloxy)benzene, have been substantially improved by the use of ambient temperature conditions. Both ease of synthesis and purity of product were improved. Precipitation conditions were developed for BATQ-H which lowered the content of BA-DAB-BA, permitting tailoring of the average length for processing and mechanical properties studies. GRA

N86-23726# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
A GENERAL PREPARATION OF TAILORED-LENGTH ACETYLENE TERMINATED RESINS FROM LOW-COST BISPHENOLS Final Report, Jun. 1981 - Dec. 1982
Frederick L. Hedberg, Marilyn R. Unroe, Patricia M. Lindley, and Marilyn E. Hunsaker May 1985 28 p
(AF Proj. 241-9)
(AD-A161902; AFWAL-TR-85-4041) Avail: NTIS
HC A03/MF A01 CSCL 11/4

An Ullmann ether reaction of 1,3-dibromobenzene or 1,4-dibromobenzene has been carried out with three low-cost bisphenols in 2, 4, 6-collidine with cuprous or cupric oxide to afford bromine terminated oligomer mixtures of stoichiometrically tailored average lengths. The use of bis-phenol A, 4, 4' - thiodiphenol and resorcinol provided three families of bromine terminated oligomer mixtures which were subsequently converted in two steps to acetylene terminated matrix resin systems for composites. Column chromatographic separations on the resins were used both to characterize the oligomer composition and to isolate for identification the major impurities present. Thermoanalytical data was obtained on the uncured and cured resins. This preparative method was also used to synthesize a monoethynyl terminated reactive diluent from 3-phenoxyphenol. GRA

N86-23727# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CREEP OF THERMOSOFTENING PLASTICS IN AIR AND IN A PHYSIOLOGICAL SOLUTION
G. I. Roytberg, V. N. Kestelman, and R. Z. Rakhimov 1 Nov. 1985 9 p Transl. into ENGLISH from Fiziko-Khimicheskaya Mekhanika Materialov (USSR), no. 5, 1972 p 81-84
(AD-A161925; FTD-ID(RS)T-0167-85) Avail: NTIS HC A02/MF A01 CSCL 20/11

The creep of polymer materials is studied predominantly under conditions of static uniaxial tension. Established at present is the existence of elastic, elasto-elastic (nonstationary) and viscous (stationary) components of total creep strain. The total strain at a constant tensile load and temperature and also the duration of the loading are connected with each other. Liquid media under these conditions do not change the shape of the creep curves. It was of interest to clarify the possibility of using a equation for describing the creep of structural thermosoftening plastics with other forms of the stressed state in air and in liquid media. We studied the creep of polymers under normal conditions in air and in the model medium - the physiological solution (0.9% solution of NaCl in distilled water) under static bending and compression. GRA

N86-23728# Aerospace Corp., El Segundo, Calif. Materials Sciences Lab.
RAIN IMPACT ASSESSMENT OF ADVANCED THERMAL PROTECTION SYSTEM MATERIALS: PHASE 1 TEST RESULTS
Robert M. Cooper 5 Sep. 1985 78 p
(Contract F04701-83-C-0084)
(AD-A162131; TR-0084A(5935-04)-2; SD-TR-85-61) Avail: NTIS HC A05/MF A01 CSCL 11/2

A rain impact test program, will study the durability of advanced thermal protection system (TPS) materials under exposure to rain conditions typical of flight. Damage threshold levels were bracketed or upper limits established for the rigid TPS materials. The borosilicate glass-coated TPS failed by flexure of the coating, and a rough correlation of rain impact resistance with the compressive modulus of the tile substrate material was found. The durability of the bare tile material was not substantially increased by the use of a SiC coating infiltrated and sintered in the surface layer. The testing technique used with the flexible cloth class of TPS entailed difficulties which precluded the acquisition of valid test data, and alternative approaches for obtaining the desired data are being explored. GRA

N86-23729# Naval Ship Research and Development Center, Annapolis, Md. Ship Materials Engineering Dept.
PREDICTIVE TEST DEVELOPMENT FOR NAVY DIESEL ENGINE LUBRICATING OILS Final Report
Michael D. Klinkhammer Nov. 1985 24 p
(AD-A162318; DTNSRDC/SME-84/90) Avail: NTIS HC A02/MF A01 CSCL 14/2

The objective of this project was to reduce the time and expense of qualification testing for candidate MIL-L-9000 diesel engine lubricating oils. Work was focused primarily on finding a short term test to correlate with Caterpillar 1G2 engine test deposit ratings. Because the 1G2 engine test deposit ratings have poor repeatability, bench test correlations were attempted using only reference oils, i.e., these oils having a large number of engine results. Three bench tests were evaluated: the Alcor 1G Deposition Test, a pressure differential scanning calorimetry method, and a microoxidation method. The Alcor Test gave good predictions of weighed total demerits by Caterpillar 1G2 for the seven reference oils available. The pressure differential scanning calorimetry method also gave a good correlation with 1G2 but only five reference oils were available for evaluation. The microoxidation method shows promise but needs more development. These tests should be evaluated further as additional 1G2 reference oils become available. GRA

N86-23730# SRI International Corp., Menlo Park, Calif.
SILICON NITRIDE JOINING Final Report, 1 Dec. 1980 - 30 Jun. 1985
Sylvia M. Johnson and David J. Rowcliffe Oct. 1985 75 p
(Contract F49620-81-K-0001)
(AD-A162337; AFOSR-85-1065TR) Avail: NTIS HC A04/MF A01 CSCL 13/8

The results obtained during the investigation of a method of joining silicon nitride with an oxide glass are described. Joining methods for silicon nitride to ceramics and metals are reviewed in Appendix A. Chemical interactions between Si3N4 and glass are described in Appendix B. Both hot-pressed and a hot-isostatically pressed Si3N4 were used for joining experiments. The vaporization behavior of the materials as determined by mass spectrometry is described. A new method of joining Si3N4 which uses very little glass and which has potential for producing joined pieces which retain their strength to high temperatures was developed and preliminary results are presented. Author (GRA)

N86-23731# Dayton Univ., Ohio.
SMALL-ANGLE NEUTRON SCATTERING ON CROSSLINK DISTRIBUTION OF EPOXY NETWORKS Interim Report, Apr. 1983 - Aug. 1984
S. J. Bai Oct. 1985 28 p
(Contract F33615-84-C-5020)
(AD-A163085; UDR-TR-85-24; AFWAL-TR-85-4111) Avail: NTIS HC A03/MF A01 CSCL 07/4

Crosslink distribution of epoxy network of diglycidyl ether of bisphenol A (DGEBA) cured with stoichiometric amounts of meta-phenylene diamine (mPDA) was examined by small-angle neutron scattering (SANS). A monodisperse DGEBA resin with the smallest molecular weight was used to enhance the crosslink density and to simplify the network structure for deuterium-labeling. Meta-phenylene-d4 diamine (mPDAd4) was applied to label definitively the crosslinks. SANS measurements covered a reciprocal space range from 0.016 to 0.220 A-1, or, equivalently, real-space distances from 400 to 30 A. Application of SANS on the deuterium-labeled epoxy networks consistently produces a constant excess intensity over the unlabeled epoxy networks. Since the scattering intensity from total correlation of the network was negligible, as evident from measurements of SANS on the unlabeled epoxy networks and small-angle X-ray scattering on the epoxy networks, the constant excess SANS intensity can only be attributed to a uniform spatial distribution of the amine curing agent. In other words, the crosslinks are distributed uniformly throughout the epoxy network. GRA

N86-23732# Colorado Univ., Boulder.
[TOPOLOGICAL STEREOCHEMISTRY] Annual Report
2 Dec. 1985 4 p
(Contract N00014-85-K-0228)
(AD-A163124) Avail: NTIS HC A02/MF A01 CSCL 07/4

During the past year, several exciting developments in topological stereochemistry have occurred, both theoretical and experimental. Concerning the theory of topological stereochemistry, the mathematics groups involved in the project have proven several of the conjectures presented in our Tetrahedron report, and exciting work on the topology front is in progress, as described in the report from the University of Iowa part of the consortium. With regard to the synthetic topological stereochemistry under way on the Boulder campus of the University of Colorado, efforts are, of course, focusing on synthesis of a molecular knotted ring. Recent results in two projects directed towards this goal are discussed in this report, one dealing with development of improved methods for breaking the rungs of the molecular Mobius ladders, and the other dealing with experiments on the four-rung THYME polyethers. A preprint of a paper accepted for publication in Tetrahedron describing this work in detail, is enclosed. GRA

N86-23733# Department of the Navy, Washington, D. C.
TRANSITION AND INNER TRANSITION METAL CHELATE POLYMERS FOR HIGH ENERGY RESIST LITHOGRAPHY Patent Application
Ronald D. Archer, Christopher J. Hardiman, Ryszard Grybos, and James C. Chieu, inventors (to Navy) Filed 14 Mar. 1985 20 p

(AD-D012053; US-Patent-Appl-SN-711786) Avail: NTIS HC A02/MF A01 CSCL 09/1

This invention relates to photoresists for lithographic purposes, and more particularly to transition and inner transition metal chelate polymers for high energy resist lithography. Such polymers are used as positive or negative resists of high sensitivity for lithographic purposes in integrated circuit chip fabrication requiring submicron resolution. The polymers when irradiated undergo scission or crosslinking events which affects their solubility in developer solvents. They are synthesized either in nonaqueous solution with subsequent removal of excess solvent or interfacially with almost instantaneous precipitation of the polymer at the interface. GRA

N86-23734# Department of the Navy, Washington, D. C.
ELECTRODEPOSITION OF REFRACTORY METAL SILICIDES Patent Application
Kurt H. Stern, inventor (to Navy) Filed 12 Dec. 1985 11 p
(AD-D012073; US-Patent-Appl-SN-808326) Avail: NTIS HC A02/MF A01 CSCL 11/3

An object of the present invention is to protect metal surfaces of any shape from abrasive and erosive wear. Another object of this invention is to provide a process for producing a hard, dense, adherent coating of any desired thickness of a refractory metal silicide. A further object of this invention is to provide a process for producing a coating of a refractory metal silicide whereby the stoichiometry of the metal silicide coating produced can be controlled. These and other objects are achieved by electrodepositing a coating of a refractory metal silicide from a solution of a desired refractory metal fluoride mixture. An anode comprised of the desired refractory metal or silicon, a cathode comprised of the object to be coated and a platinum reference electrode are immersed in the melt. When a voltage is applied between the platinum electrode and the cathode the silicon and the refractory metal cations in the solution are simultaneously reduced at the cathode to form a metal silicide coating upon the object. GRA

N86-23735# Pacific Northwest Lab., Richland, Wash.
FABRICATION AND CHARACTERIZATION OF MCC APPROVED TESTING MATERIAL: ATM-1 GLASS
J. W. Wald Oct. 1985 37 p
(Contract DE-AC06-76RL-01830)
(DE86-003795; PNL-5577-1) Avail: NTIS HC A03/MF A01

The materials characterization center approved testing material ATM-1 is a borosilicate glass that incorporates nonradioactive constituents and uranium to represent high-level waste (HLW) resulting from the reprocessing of commercial nuclear reactor fuel. Its composition is based upon the simulated HLW glass type 76-68 to which depleted uranium has been added as UO2. Three separate lots of ATM-1 glass have been fabricated, designated ATM-1a, ATM-1b, and ATM-1c. Limited analyses and microstructural evaluations were conducted on each type. Each lot of ATM-1 glass was produced from a feedstock melted in an air atmosphere at between 1150 to 1200 C and cast into stress annealed rectangular bars. Bars of ATM-1a were nominally 1.3 x 1.3 x 7.6 cm (approx. 36 g each), bars of ATM-1b were nominally 2 x 2.5 x 17.5 cm (approx. 190 g each) and bars of ATM-1c were nominally 1.9 x 1.9 x 15 cm (approx. 170 g each). Thirteen bars of ATM-1a, 14 bars of ATM-1b, and 6 bars of ATM-1c were produced. Twelve random samples from each of lots ATM-1a, ATM-1b, and ATM-1c were analyzed. The concentrations (except for U and Cs) were obtained by Inductively-Coupled Argon Plasma Atomic Emission Spectroscopy analysis. Cesium analysis was performed by Atomic Absorption Spectroscopy, while uranium was analyzed by Pulsed Laser Fluorometry. The X-ray diffraction analysis of four samples indicated that lot ATM-1a had no detectable crystalline phases (< 3 wt %), while ATM-1b and ATM-1c contained approx. 3 to 5 wt % % iron-chrome spinel crystals. These concentrations of secondary spinel component are not considered uncommon. Scanning electron microscopy examination of fracture surfaces revealed only a random, apparently crystalline, second phase (1 to 10 micron m diam) and a random distribution of small voids or bubbles (approx. 1 micron m nominal diam). DOE

N86-23736# Pacific Northwest Lab., Richland, Wash.
RESULTS FROM THE LONG-TERM INTERACTION AND MODELING OF SRL-131 GLASS WITH AQUEOUS SOLUTIONS
D. M. Strachan, L. R. Pederson, and R. O. Lokken Nov. 1985 117 p
(Contract DE-AC06-76RL-01830)
(DE86-003800; PNL-5654) Avail: NTIS HC A06/MF A01

Leaching studies on SRL-131 simulated defense waste glass have been carried out for a duration of 2 years. This glass contained nonradioactive elements and depleted uranium to simulate the waste content. The leachants used in this study were deionized water, a sodium bicarbonate/silicic acid solution (silicate water), a synthetic groundwater, and a high ionic strength K-Mg-Na-Cl brine. Two temperatures were used: 40 C and 90 C. The long-term results were in fair agreement with modeling calculations performed using the PHREEQE geochemical code. The leachability of SRL-131 glass from results up to 2 years followed the trend: deionized water > silicate water > synthetic groundwater > salt brine at 40 C and deionized water approx. = synthetic groundwater > silicate water > salt brine at 90 C. Solid state analyses are reported along with an Appendix containing a complete data set. DOE

N86-23737# Pacific Northwest Lab., Richland, Wash.
FABRICATION AND CHARACTERIZATION OF MCC APPROVED TESTING MATERIAL: ATM-8 GLASS
J. W. Wald Oct. 1985 37 p refs
(Contract DE-AC06-76RL-01830)
(DE86-003801; PNL-5577-8) Avail: NTIS HC A03/MF A01

The Materials Characterization Center (MCC) Approved Testing Material ATM-8 is a borosilicate glass that incorporates elements typical of high-level waste (HLW) resulting from the reprocessing of commercial nuclear reactor fuel. Its composition is based upon the simulated HLW glass type 76-68 to which depleted uranium, technetium-99, neptunium-237 and plutonium-239 have been added at moderate to low levels. The glass was requested by the Nevada Nuclear Waste Storage Investigations (NNWSI) Project. ATM-8 glass was produced in April of 1984, and is the second in a series of testing materials for NNWSI. This report discusses its fabrication (starting materials, batch and glass preparation, measurement and testing equipment, other equipment, procedures, identification system and materials availability and storage, and characterization (bulk density) measurements, chemical analysis, microscopic examination, and X-ray diffraction analysis. DOE

N86-23738# Allied Bendix Corp., Kansas City, Mo.
EVALUATION OF HEAT-SHRINKABLE POLYOLEFIN TUBING Final Report
F. N. Larsen Dec. 1985 14 p
(Contract DE-AC04-76DP-00613)
(DE86-004381; BDX-613-3358) Avail: NTIS HC A02/MF A01

Polyolefin heat-shrinkable tubing was evaluated for parameters leading to splitting of the tubing. It was concluded that temperature cycling from ambient to 250 F, which is above the polymer crystalline melt of 218 F induces stresses which cause splitting of the tubing. It was also determined that as-received (unshrunk) tubing is more susceptible to notch sensitivity and splitting than the shrunk tubing after processing. Lowering the thermal exposure temperature to 160 F eliminated the splitting problem. Chemical characterization of the straight tubing and a molded boot material showed similar composition regarding flame retardants and additives. The molded boot material should be an acceptable substitute for the tubing from an aging and compatibility viewpoint. DOE

N86-23739# Fraunhofer Inst. fuer Werkstoffmechanik, Freiburg (West Germany).
STRENGTH PROPERTIES OF CERAMIC MATERIALS UNDER LONG TERM LOADING AND UNDER THE INFLUENCE OF

RESIDUAL COMPRESSION STRESSES Final Report, Jun. 1983
Guenter Kleer, Herbert Richter, Rolf Pruemmer, and Hans-Wulf Pfeiffer-Vollmar Bonn Bundesministerium fuer Forschung und Technologie Oct. 1985 108 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-85-112; ISSN-0340-7608) Avail: NTIS HC A06/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 22.50

Strength properties of SiC and Si3N4 ceramics were investigated at room temperature and at high temperatures. Crack growth experiments were performed on double torsion specimens, and strength tests were run on four-point bending specimens at different loading rates. The parameters characterizing material behavior at short and long term loading, especially at high temperatures were determined. Lifetimes were calculated on the basis of the measured crack growth parameters and were compared with experimental values; agreement is not found in all cases. The influence of the surface state on the strength was determined by X-ray stress analysis. The X-ray elastic constants describing the lattice strain-stress relation and the residual stress values are obtained. Author (ESA)

N86-23740# Volkswagen A.G., Wolfsburg (West Germany). Forschung Antriebstechnik.
CERAMIC TURBINE ROTORS Final Report, Jun. 1983
Manfred Langer and Johann Siebels Bonn Bundesministerium fuer Forschung und Technologie Oct. 1985 71 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-85-115; ISSN-0340-7608) Avail: NTIS HC A04/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 15

The development status of turbine rotors made of nonoxide ceramic materials, and the results of materials investigations are presented. The selected ceramic materials were silicon nitride and silicon carbide from various processes. For automotive gas turbine applications, hybrid rotor types with metallic hub and ceramic single blades were investigated. Monolithic rotor prototypes were tested for 50hr in a car under realistic diesel engine conditions. Materials tests concentrated on thermal stability, joining techniques, and microanalysis. Components and materials development are discussed. Author (ESA)

N86-23741# Battelle Columbus Labs., Ohio.
TIE MOLECULES IN POLYETHYLENE Final Report, Apr. 1982 - Jun. 1985
A. Lustiger Jun. 1985 130 p refs Sponsored by Gas Research Inst.
(PB86-125101; GRI-85/0129) Avail: NTIS HC A07/MF A01 CSCL 11I

On a molecular level, slow crack growth brittle-type fracture occurs through separation of lamellae. Tie molecules are the links which hold these lamellae together. The importance of tie molecules in long term strength, the existence of a craze at the crack tip, and an analytical technique to measure tie molecule concentration in polyethylene (PE) is developed. Environmental stress cracking was induced in polyethylene pipe to observe the preferential path for fracture initiation. Interlamellar links were found to break under environmental stress cracking conditions. For analytical measurement of tie molecules, three medium density polyethylene resins, were used. Torsion pendulum testing involved detection of a so-called upper glass transition temperature associated in the literature with restrained amorphous material. Infrared dichroism was used to measure amorphous orientation in strained polyethylene films. Trends in the latter results reflect presumed tie molecule concentration. GRA

N86-23742# Washington Univ., St. Louis, Mo. Materials Research Lab.
STRUCTURE AND PROPERTIES OF POLYETHYLENE Final Report, Jan. 1983 - Jun. 1984
J. L. Kardos, R. L. Powell, K. L. Jerina, N. Hosangady, and Y. Chen May 1985 195 p
(Contract GRI-5081-260-0561)
(PB86-125127; GRI-85/0177) Avail: NTIS HC A09/MF A01 CSCL 11I

Both isotropic and anisotropic (extruded pipe analogue) polyethylene sheets have been successfully modeled as composite materials, and the stiffness and yield strength predicted as a function of degree of orientation, volume fraction crystallinity, amorphous phase modulus, and crystallite aspect ratios. Three-dimensional property maps show that lower crystallite aspect ratios (and hence different crystallization/processing conditions) are needed to achieve maximum stiffness than are required for maximum strength. Optimization and feasible optimum algorithms were developed, which, for specified values of design strength and stiffness, yielded ranges for various pairs of variables which would be feasible under practical processing limitations. A rheological data base has been obtained for melts of the above three polymers, including steady-state viscosity-shear rate relations, linear viscoelastic properties and relaxation behavior. GRA

N86-23743# United Kingdom Atomic Energy Authority, Harwell (England). Materials Development Div.
DISTRIBUTION OF HYDROGEN IN THE NPL STANDARD Ta SUB 2 O SUB 5 FILMS
H. E. Bishop Sep. 1985 17 p refs
(AERE-R-11922) Copyright. Avail: Issuing Activity

Well characterized tantalum pentoxide anodized films were produced for use as a thickness and depth resolution standard for profiling in surface analytical techniques. Very sharp interfaces for these films were demonstrated using Auger Electron Spectroscopy. Studying these films by dynamic Secondary Ion Mass Spectroscopy in the CAMECA IMSS 3F, well defined profiles with a sharp interface were obtained with an oxygen primary beam. More complex profiles were obtained with argon and caesium primary beams, apparently showing the presence of hydroxide at the metal/oxide interface and a high concentration of hydrogen in the metal near the surface. However, an argon primary beam with an oxygen flood gave the same type of profile as that obtained with an oxygen primary beam. Elastic Recoil Detection Analysis confirmed that there was no high concentration of hydrogen at the metal/oxide interface and showed that hydrogen in the tantalum was present at 1 atom %. Author

N86-23777# Joint Publications Research Service, Arlington, Va.
PRESENT STATUS AND PROSPECTS OF FINE CERAMICS
Eiji Kamijo *In its* Japan Report: Science and Technology (JPRS-JST-86-007) 25 Mar. 1986 p 41-57 Transl. into ENGLISH from Kino Zairyo (Tokyo, Japan), Jul. 1985 p 14-23 (For primary document see N86-23773 14-31)
Avail: NTIS HC A04/MF A01

N86-24519*# Calhoun Community Coll., Decatur, Ala. Dept. of Natural Sciences.
FOAM FLOTATION AS A SEPARATION PROCESS
Ben L. Currin *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 15 p refs (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 11G

N86-24534*# Oregon Univ., Eugene. Dept. of Chemistry.
INVESTIGATIONS OF TOUGHENING MECHANISMS OF EPOXY RESINS
T. Koenig *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 22 p refs (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 11B

N86-24538*# Athens Coll., Ala. Dept. of Chemistry.
DIELECTRIC CURE MONITORING OF THE 55A FILAMENT WOUND CASE RESIN

Ronald C. McNutt *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 27 p refs (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 11B

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers; storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N86-23744*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
LIQUID HYDROGEN POLYGENERATION SYSTEM AND PROCESS Patent Application
Peter A. Minderman, Gary P. Gutkowski, Lawrence Manfredi, Julian V. King, and Frank S. Howard, inventors (to NASA) Filed 15 Nov. 1985 23 p
(NASA-Case-KSC-11304-2; NAS 1.71:KSC-11304-2; US-Patent-Appl-SN-789713) Avail: NTIS HC A02/MF A01 CSCL 21I

An integrated polygeneration system and process is disclosed for generating liquid hydrogen as a main energy product for use as a propellant for space vehicles. Secondary energy products and commodities for supporting a space center complex and launching of the space vehicle includes the production of electrical and thermal energy and gaseous nitrogen. The integrated process includes a coal gasification and gas cleanup system, a combined cycle power generation system, a hydrogen production and liquefaction system and a air separation system. A medium BTU gas is produced by the coal gasification system. Steam also produced in the coal gasification process is delivered to a steam turbine in the combined cycle power generation system. NASA

N86-23745# Southwest Research Inst., San Antonio, Tex.
MICROENCAPSULATION OF LITHIUM Final Report, 12 Feb. - 31 Dec. 1985
Mary Marshall 31 Dec. 1985 66 p
(Contract DAAK70-85-C-0008; DA Proj. 1L1-62733-AH-20)
(AD-A162987) Avail: NTIS HC A04/MF A01 CSCL 11/3

The U.S. Army Belvoir Research and Development Center requires protection of element lithium from reactive species (especially oxygen) during mixing and storage operations of lithium in explosives. Furthermore, it is required that the detonation not be hindered by the coating material. SwRI used microencapsulation technology to develop a protective coating for elemental lithium. The coating material studied was a blend of wax, PICCOLYTE, and polyethylene known to have good water barrier properties and combustion characteristics. SwRI prepared microspheres from a dispersion of micronized lithium metal in a matrix material (the protective barrier). The process to form microspheres is carried out in an inert atmosphere to prevent the micronized lithium metal from reacting prior to encapsulation. Highly reactive micronized lithium metal was successfully encapsulated under this program. The encapsulated lithium dramatically increases the shelf-life and decreases the associated hazards of the elemental lithium. Experimental procedure required that the encapsulation be performed in an inert atmosphere (lithium powder readily reacts with water, nitrogen, oxygen, etc.) and that non-reactive coating materials were developed. GRA

N86-23746# Argonne National Lab., Ill.
PRODUCTS OF THE NEUTRALIZATION OF HYDRAZINE FUELS WITH HYPOCHLORITE
K. L. Brubaker, J. R. Stetter, J. C. Demirgian, A. Boparai, and J. F. Schneider 1985 8 p Presented at the JANNAF Safety and Environmental Protection Subcommittee Meeting, Monterey, Calif., 4 Nov. 1985
(Contract W-31-109-eng-38)
(DE86-004049; CONF-8511110-4) Avail: NTIS HC A02/MF A01

Neutralization of hydrazine fuels with hypochlorite is a recommended procedure for treatment of fuel spills. Earlier publications have reported some of the major reaction products and have suggested that incomplete reaction and reaction with impurities may lead to formation of environmentally and toxicologically significant substances. The results presented in this paper were obtained as part of a program to assess the environmental implications of using the hypochlorite method for treatment and disposal of hydrazine fuel spills. The fuel sample impurities analyzed, the analytical protocols used, and the chemical compounds produced by neutralization of hydrazine fuels with hypochlorite are discussed. The fuels examined were hydrazine, monomethylhydrazine, unsymmetrical dimethylhydrazine, and Aerozine-50. The neutralization products were determined under experimental conditions comparable to those expected for actual spills. Major products, as well as environmentally significant minor products, were identified using gas-chromatography/mass-spectrometry and gas-chromatography/Fourier-transform-infrared-spectroscopy. DOE

N86-23747# Pacific Northwest Lab., Richland, Wash.
UPGRADING BIOMASS LIQUID FUELS
D. C. Elliott and E. G. Baker Oct. 1985 18 p refs Presented at the Biomass Thermal Chemical Conversion Contractors' Meeting, Minneapolis, Minn., 15 Oct. 1985
(Contract DE-AC06-76RL-01830)
(DE86-004020; PNL-SA-13476; CONF-8510167-3) Avail: NTIS HC A02/MF A01

Catalytic hydrotreating of wood-derived liquids is being studied using a continuous-feed, fixed-bed reactor. Commercial hydrotreating catalysts and conditions are used to hydrodeoxygenate and hydrocrack the biomass liquefaction products generated by high-pressure processing. Biomass flash pyrolyzates require alternate processing to first stabilize the products prior to catalytic hydrotreating. Experiments are performed in an upflow reactor wherein both liquid phase and gas phase reactions are considered to be important. Although hydrocarbons are not produced in any significant amount by thermochemical direct liquefaction of wood, the use of a secondary hydrogenation step to treat the initial product can result in nearly pure hydrocarbons. These hydrocarbons are primarily cyclics and aromatics which would be useful in gasoline blending. Experimental results with either cobalt/molybdenum or nickel/molybdenum catalyst show that deoxygenation of the primarily phenolic wood oil is achieved in either case. The extent of saturation of the liquid product is dependent on catalyst type, operating temperature and relative flows of oil feedstock and hydrogen gas. DOE

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N86-23748 Department of the Air Force, Washington, D.C.
MACHINING A COOLED CYLINDRICAL OPTIC TO COMPENSATE FOR PRESSURE DISTORTION Patent
Frederick G. Eitel, inventor (to Air Force) Issued 19 Nov. 1985 7 p Supersedes AD-D010418
(AD-D012068; US-Patent-4,553,457; US-Patent-Appl-SN-505166; US-Patent-Class-82-1C) Avail: US Patent and Trademark Office CSCL 20/4

A system for, and a method of, replicating the known (i.e., ascertained) operational coolant fluid flow local pressure in an optical surface (such as a mirror surface) of the heat exchanger portion of a fluid cooled cyclindrical optic is presented. The system essentially comprises a precision numerically controlled lathe having a selectively rotatable spindle on which is mounted, with a hollow adapter, the cylindrical optic in which is retained a fluid connector that is in communication with the adapter which, in

turn, is in communication with a source of pressurized fluid containing a fluid whose rate of flow and pressure can be regulated. The pressurized fluid flows serially into the adapter, the connector and the cylindrical optic and its optical surface, thereby replicating the operational fluid flow pressure through the entire optical surface, without the prior art problem of pressure drops in and pressure deflection of the optical surface which, in turn caused residual finish figure machining error in the optical surface. As a result of the use of this system, and of the performance of the steps comprising the method of replicating the operational fluid flow pressure in the entire optical surface, this prior art residual finish figure machining error is eliminated or at least is significantly minimized. GRA

N86-23749*# National Aeronautics and Space Administration, Washington, D.C.
CHINESE SPACE AND AVIATION INDUSTRIES SCORE MAJOR BREAKTHROUGHS
R. Hu Apr. 1986 16 p Transl. into ENGLISH from Xiandai Junshi (Conmilit) (Hong Kong), v. 9, no. 11, 1 Jan. 1986 p 88-91 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-4005)
(NASA-TM-87973; NAS 1.15:87973) Avail: NTIS HC A02/MF A01 CSCL 13H

An overview of the current status of China's aviation and aerospace industries is presented, as well as planned future development and areas of importance for China's future space programs. The development of China's CZ-1, CZ-2 and CZ-3 rocket program is discussed, as well as China's satellite launch capabilities. China's first geostationary communications satellite STW-1 is also mentioned, and further development of the second and third communications satellites to be launched in 1987 are shown. Other developments include a seventh low Earth orbiting photographic reconnaissance satellite, plans for an image transmitting remote sensing satellite to be launched in 1988 to 1990, and other satellite developments. The Chinese-designed Y-10 transport aircraft is discussed, as well as the TU-16 bomber aircraft and the co-production agreement with McDonnell Douglas for the MD-82 passenger aircraft. Author

N86-23750*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
METHOD FOR MACHINING HOLES IN COMPOSITE MATERIALS Patent Application
Johnny M. Clemons, Frank E. Ledbetter, Julia G. Daniels, and Benjamin G. Penn, inventors (to NASA) Filed 3 Dec. 1985 9 p
(NASA-Case-MFS-28044-1; NAS 1.71:MFS-28044-1; US-Patent-Appl-SN-804039) Avail: NTIS HC A02/MF A01 CSCL 13H

A method for boring well defined holes in a composite material such as graphite/epoxy is discussed. A slurry of silicon carbide powder and water is projected onto a work area of the composite material in which a hole is to be bored with a conventional drill bit. The silicon carbide powder and water slurry allow the drill bit, while experiencing only normal wear, to bore smooth, cylindrical holes in the composite material. NASA

N86-23751# Southeastern Center for Electrical Engineering Education, Inc., St. Cloud, Fla.
USAF/SCEEE (UNITED STATES AIR FORCE/SOUTHEASTERN CENTER FOR ELECTRICAL ENGINEERING EDUCATION) RESEARCH INITIATION PROGRAM RESEARCH REPORTS, VOLUME 1 Interim Report
Warren D. Peele Mar. 1985 125 p
(Contract F49620-82-C-0035)
(AD-A161907; AFOSR-85-0904TR-Vol-1) Avail: NTIS HC A06/MF A03 CSCL 09/3

A partial table of contents of this USAF/SCEE report follows: A Statistic For Measuring The Balance Of A Sample; Numerical And Analytical Study of High Resolution Limb Spectral Radiance From Non-Equilibrium Atmospheres; Electron Waves In The Electrical Breakdown of Gases, With Application to The Dart Leader in Lightning; Investigation of Liquid Sloshing In Spin-Stabilized Satellites; Surface Potential as a laser Damage Diagnostic; A Study of Slot Waveguides For Electrostatistically Variable SAW Delay Lines; Combustion Modeling of Homogeneous Solid Propellants with Selectively Absorbing Inert Particle Additives; Interim Report Development and Testing of an Animal Model of State Dependent Effects With Atrophine; Combined Blast and Fragment Loading of Reinforced Concrete; Infrared Spectroscopy of Extrinsic P-Type Silicon; Interfacing or Models and Information Systems: A Systematic Approach; the Proton in Multisolvent Clusters; Laser Damage in Crystalline Silicon Observed under RHEED; Analysis of Swirling Nozzle Flow by a Time-Dependent finite Difference Technique; Analysis of Condensation Phenomena for Conventional Heat Pipes; Avionics Reliability Analysis; and Communications network Simulation topics With a Computer network Simulation Model; GRA

N86-23752# Southeastern Center for Electrical Engineering Education, Inc., St. Cloud, Fla.
USAF/SCEEE (UNITED STATES AIR FORCE/SOUTHEASTERN CENTER FOR ELECTRICAL ENGINEERING EDUCATION) RESEARCH INITIATION PROGRAM RESEARCH REPORTS, VOLUME 2 Interim Report
Warren D. Peele Mar. 1985 987 p
(Contract F49620-82-C-0035)
(AD-A161908; AFOSR-85-0905TR-Vol-2) Avail: NTIS HC A99/MF A03 CSCL 09/3

A partial contents of this USAF/SCEEE report follows: A Study in the Mechanical Characterization of Advanced Composite Laminates; Modeling of Multi-Echelon and Multi-Indenture Items with Limited Repair and Transportation During War Time Emergencies; The Effect of Moderate to High Pitching Rates on the Aerodynamic Performance of a NACA 0015 Airfoil at a Reynolds No. of 100,000; Kinetic Energy Dependence of Ion Polar Molecule Collision Rate Constants by Trajectory Calculations; A Dynamic Resource Allocation Model; Electron Paramagnetic Resonance Study of Defects in III-V Semiconductor; and Effect of the Graph on Comprehension and Long-Term Recalls of the Text: Eye Movements in Reading. GRA

N86-23753# Office of Naval Research, London (England).
EUROPEAN SCIENCE NOTES. VOLUME 40, NUMBER 1
Larry E. Shaffer Jan. 1986 43 p
(AD-A162235; ESN-40-1) Avail: NTIS HC A03/MF A01 CSCL 05/2

European Science Notes is a monthly publication with brief articles on recent developments in European scientific research. Partial contents: Shallow Water Acoustic at the UK's Royal Aircraft Establishment; Immunology Research in Israel; Life Sciences Research at the Weizmann Institute of Science; Symposium on Macromolecules; Mass Spectrometry Meetings; Automation and Robotization in the Welding Industry; 3rd International Conference on Composite Structures; Conference on Quantum Electronics; Very Short Laser Pulse Research. GRA

N86-23754# Naval Postgraduate School, Monterey, Calif.
THE SIMULATION OF REMOTELY MEASURED PATHS OF UNDERWATER VEHICLES FOR THE PURPOSE OF MONITORING THE CALIBRATION OF TEST RANGES M.S. Thesis
Gene Gygax Sep. 1985 107 p
(AD-A162261) Avail: NTIS HC A06/MF A01 CSCL 17/1

This thesis analyses data of and builds a simulation model for the track of an underwater vehicle as perceived by a test range of three dimensional short baseline sonar arrays. In this way many random replications of track become available quickly and inexpensively. These simulations support a larger project whose object is to monitor the performance of the test range and provide clues for troubleshooting problems. In particular, joint values of sensor array estimated displacement and reorientation corrections are generated and their error distribution is quantified.
Author (GRA)

N86-23755# Illinois Inst. of Tech., Chicago.
BASIC AND APPLIED MAGNETISM WITH A SQUID GRADIOMETER Final Report, Aug. 1982 - Aug. 1983

Harold Weinstock, M. N. Nisenoff, and T. Erber Dec. 1985 28 p
(Contract N00014-82-K-2042)
(AD-A162890) Avail: NTIS HC A03/MF A01 CSCL 14/2

A facility was established to evaluate the magnetic signatures of cryocoolers, i.e., small closed-cycle liquid helium refrigerators, by use of a (superconducting) SQUID gradiometer. This gradiometer also was utilized to study the: (1) threshold of Barkhausen emission and onset of hysteresis in iron, (2) detection of defects in metal pipes by remote sensing, and (3) magnetoelastic behavior in steel bars. GRA

N86-23756# Purdue Univ., West Lafayette, Ind. School of Industrial Engineering.
THE SCIENCE OF AND ADVANCED TECHNOLOGY FOR COST-EFFECTIVE MANUFACTURE OF HIGH PRECISION ENGINEERING PRODUCTS. VOLUME 3: GEOMETRIC ADAPTIVE CONTROL FOR ACCURACY AND STABILITY IN MACHINING CYLINDRICAL WORKPIECE Ph.D. Thesis Final Report, 1 Jan. 1983 - 15 Aug. 1985
Yhu-Tin Lin and C. R. Liu Sep. 1985 191 p
(Contract N00014-83-K-0385)
(AD-A163003) Avail: NTIS HC A09/MF A01 CSCL 13/8

A new geometric adaptive control (GAC) system has been developed for improving the accuracy and stability in machining cylindrical workpiece. The system takes into consideration error generation process, machine tool dynamics, and metrology. The new stochastic model constructed in this thesis provides not only insight into the nature of machining processes, but also a means for the systematic design of geometric adaptive controllers. The adaptive control algorithms for the GAC system are derived by using the theory of self-tuning control (STC). The algorithms are simple, robust, and suitable for microprocessor implementation. Whitehouse's multiprobe measurement is modified for use in the control system for the first time. Interesting properties of this measurement in control are analyzed and predicted. The results of simulation show that the GAC system can improve both the accuracy and the stability considerably. Through the theoretical analysis it was possible to resolve the control problems imposed by multiprobe measurement, and to achieve near optimum control performance. A comparison with another GAC system which uses FCC technique is made to show that the proposed GAC system does have better performance than other existing GAC systems in precision machining. Author (GRA)

N86-23757# Lawrence Livermore National Lab., Calif.
MATERIALS PHYSICS, H DIVISION Quarterly Report, Oct. - Dec. 1984
Aug. 1985 51 p
(Contract W-7405-eng-48)
(DE86-002901; UCID-18574-84-4) Avail: NTIS HC A04/MF A01

The following were studied: phase transition in fluid nitrogen at high densities and temperatures, recovery of shocked Nevada tuff to 1.2 Mbar, high pressure studies on Nd using diamond-anvil apparatus, pressure dissociation of solid nitrogen under 1 Mbar, liquid scaling equation of state revisited, test of 3d transition metal pair potentials in the T=0 solid, heat flow in solids, flow instabilities in liquid propellant combustion, and the effect of compliant material response on Tollmein-Schlichting instability growth rates. DOE

N86-23758# Industrial Environmental Research Lab., Research Triangle Park, N. C.
OPERATIONAL AND ENVIRONMENTAL IMPACTS OF CLOSED CYCLE COOLING SYSTEMS
T. G. Brna Oct. 1985 32 p
(PB86-117157; EPA-600/D-85-249) Avail: NTIS HC A03/MF A01 CSCL 13B

The paper give results of a study of operational and environmental impacts of closed cooling systems, used for about a quarter of the nation's steam-electric generating capacity. Conclusions relating to operational impacts include: (1) closed cycle cooling leads to increased power plant heat rates relative to an open cycle cooling system, but is finding increased application at power plants in order to meet environmental or siting constraints (the wet cooling tower is the most often selected closed cycle cooling system); and (2) closed cycle cooling systems are more costly, in terms of both capital and annualized costs, than open cycle cooling (wet cooling towers are usually the least costly closed cycle cooling system, while dry cooling towers are the most expensive). GRA

N86-23759# Solar Turbines International, San Diego, Calif.
CERAMIC RECUPERATOR MODULE VERIFICATION TESTS Topical Report, Jan. - Dec. 1984
M. E. Ward and T. A. Argabright Jul. 1985 23 p
(Contract GRI-5083-233-0872)
(PB86-104775; SR85-R-5126-17; GRI-85/0154) Avail: NTIS HC A02/MF A01 CSCL 13A

The project objective is to develop a ceramic recuperator suitable for high temperature, corrosive industrial process stack environments. This topical report covers the performance and thermal cycling tests of the prototype ceramic recuperator module. A full-size, self-contained ceramic recuperator module was constructed and subjected to 150 hours of testing which included 30 start-stop cycles and 500 thermal exclusions in a 2100 F simulated furnace exhaust gas stream. No degradation of the module was observed. GRA

N86-23760# California Univ., Berkeley. Earthquake Engineering Research Center.
SIMPLE MODEL FOR REINFORCING BAR ANCHORAGES UNDER CYCLIC EXCITATIONS
F. C. Filippou Mar. 1985 77 p
(PB86-112919; UCB/EERC-85/05) Avail: NTIS HC A05/MF A01 CSCL 13M

A simple and computationally attractive model of the hysteretic response of reinforcing bar anchorages under severe cyclic excitations is presented. The model is based on a piecewise linear approximation of the bond stress distribution function along the bar anchorage length. Only three intermediate points located between the ends of the bar suffice to yield results which match the finite element solution of the problem. The bond stress value at these intermediate points is established by iteratively satisfying the equilibrium and compatibility equations of the bond problem. The proposed model is used to calculate the response of the bottom reinforcing bars of an interior beam-column joint subjected to deformation reversals of increasing magnitude as weil as the response of a single reinforcing bar subjected to cyclic push-pull. The results are compared with the finite element solution of the studied cases. Author (GRA)

N86-23761# California Univ., Berkeley. Earthquake Engineering Research Center.
SIMPLIFIED METHODS OF ANALYSIS FOR EARTHQUAKE RESISTANT DESIGN OF BUILDINGS
E. F. Cruz and A. K. Chopra Feb. 1985 260 p
(Grants NSF CEE-81-05790; NSF CEE-84-02271)
(PB86-112299; UCB/EERC-85/01; NSF/ENG-85020) Avail: NTIS HC A12/MF A01 CSCL 13M

The accuracy of the response spectrum analysis (RSA) for estimating the maximum response of a building directly from the earthquake design spectrum is evaluated with the objective of developing better simplified analysis procedures suitable for preliminary design of buildings and for inclusion in building codes. Recognizing that the earthquake response of many buildings can be estimated by considering only the first two vibration modes in the response spectrum analysis (RSA) procedure, a simplified response spectrum analysis (SRSA) procedure is presented. Formulas for base shear, height-wise distribution of lateral forces, and computation of overturning moments specified in three design documents -- Uniform Building Code, Mexico's Federal District Building Code, and ATC-3 design provisions -- are evaluated in light of the results of dynamic analysis of buildings. Author (GRA)

N86-23762# Joint Publications Research Service, Arlington, Va.
CHINA REPORT: SCIENCE AND TECHNOLOGY
11 Feb. 1986 143 p Transl. into ENGLISH from various Chinese

articles
(JPRS-CST-86-005) Avail: NTIS HC A07/MF A01

Articles and abstracts from several Chinese publications are given. While most of the articles are devoted to science and technology of a national interest, some concern the applied sciences and the abstracts are in the area of infrared research, mining and metallurgy, optical science, and space science. For individual titles, see N86-23763 through N86-23767.

N86-23763# Joint Publications Research Service, Arlington, Va.
CHINA DEVELOPS ADVANCED LASER CRYSTAL c76
In its China Report: Science and Technology (JPRS-CST-86-005) 11 Feb. 1986 p 119 Transl. into ENGLISH from Xinhua (Beijing, China), 23 Dec. 1985 (For primary document see N86-23762 14-31)
Avail: NTIS HC A07/MF A01

China has developed an advanced laser crystal. The nonlinear optical material is an artificially grown monocrystal called potassium titanyl phosphate. It can turn invisible infrared laser light into a high frequency visible green laser light, increasing the penetrating capacity through sea water and other media. Scientists said that the new crystal will be used for submarine laser communications, continental shelf surveys, and satellite distance measurement. It can also be applied to laser therapy, detection of deep-sea fish schools, holography, and other fields. Experts here said that only China and the United States have such a crystal applicable to laser equipment. China developed the monocrystal in a little more than a year using an improved flux process, according to the experts. Author

N86-23764# Joint Publications Research Service, Arlington, Va.
HIGH-SPEED HOLOGRAM CAMERA DEVELOPED Abstract Only c35
In its China Report: Science and Technology (JPRS-CST-86-005) 11 Feb. 1986 p 120 Transl. into ENGLISH from Xinhua (Beijing, China), 12 Dec. 1985 (For primary document see N86-23762 14-31)
Avail: NTIS HC A07/MF A01

A high speed hologram camera, believed to be world class, was developed by Tianjin University scientists. It can shoot four photos in succession in transients of 2-100,000th of a second, with an interval of 5-millionth of a second between photos. At present, two photos are the international norm for such instruments, according to a university spokesman. The camera, developed by faculty members of the university's department of precision instruments, is designed to shoot transient processes like the vibration of lathe tools at high speed rotation. The components of the camera are all made in China, the spokesman said. Author

N86-23765# Joint Publications Research Service, Arlington, Va.
STUDY ON NORMALIZATION OF INSTRUMENT FOR MEASURING MODULATED TRANSFER FUNCTION IN INFRARED RANGE AT ZERO SPATIAL FREQUENCY Abstract Only c35
Zhuoxiang Feng and Zhongben Liu *In its* China Report: Science and Technology (JPRS-CST-86-005) 11 Feb. 1986 p 131-132 Transl. into ENGLISH from Hongwai Yanjiu (Shanghai, China), vol. 4, no. 5, Oct. 1985 p 335-340 (For primary document see N86-23762 14-31)
Avail: NTIS HC A07/MF A01

While measuring the modulated transfer function (MTF), the normalization precision at zero spatial frequency can affect measurement accuracy of MTF. Two computing methods of instrument normalization are discussed for MTF measurement in the infrared range: rectangular grating and wagon wheel chopper. These two methods are compared with each other. An instrument was developed for measuring MTF in the infrared range. The instrument accurately measures for the 2 to 14 micrometer wave band. The optical system is shown. Author

N86-23766# Joint Publications Research Service, Arlington, Va.
FLUORESCENT SPECTRA OF Cr3+ IONS IN OXIDES OF HIGH VALENT-CATIONS, POSSIBILITY TO USE THEM AS TUNABLE LASER MATERIALS Abstract Only c76
Zundu Luo, Jiming Chen, and Tao Chen *In its* China Report: Science and Technology (JPRS-CST-86-005) 11 Feb. 1986 p 132 Transl. into ENGLISH from Hongwai Yanjiu (Shanghai, China), v. 4, no. 5, Oct. 1985 p 355-360 (For primary document see N86-23762 14-31)
Avail: NTIS HC A07/MF A01

The fluorescent spectra and fluorescent lifetime measurements of Cr3(+) ions in four oxides (potassium aluminum molybdate, aluminum tungstate, aluminum niobate and aluminum tantalate) are reported. The wavelength of the fluorescent peaks of these samples is longer and their bandwidth wider than that of alex-drite and many other chromium doped tunable laser materials. The crystal field of the Cr3(+) ions is weakened by the polarization effect of the high valent-cations. These materials have a strong enough electron-phonon coupling or large enough Huang-Rhys factors. In this way one can expect to obtain a series of tunable laser materials which have a broad tunable range and a wavelength of emission peaks longer than 800 nm. The fluorescent spectra and absorption spectra of Cr3(+) is shown, a fluorescent measurement device layout and its measurement of fluorescent lifetime using a pulse decay method. Author

N86-23767# Joint Publications Research Service, Arlington, Va.
DATA ANALYSIS OF INFRARED REFLECTION SPECTRA OF LINbO3 AND OTHER CRYSTALS Abstract Only c76
Yan Liu and Liji Liao *In its* China Report: Science and Technology (JPRS-CST-86-005) 11 Feb. 1986 p 137 Transl. into ENGLISH from Gunagxue Xuebao (Shanghai, China), v. 5, no. 11, Nov. 1985 p 1046-1055 (For primary document see N86-23762 14-31)
Avail: NTIS HC A07/MF A01

Data analysis is made by using the classical oscillator fit method with preliminary data obtained form a Kramer-Kronig analysis which leads to a rapid convergence of the procedure. It was found that the procedure can be used satisfactorily for the analysis of infrared reflection spectra of both the crystals with separated bands, and LiNbO3 with overlapping bands having remarkably different intensities. Even those spectra with weak bands fading into strong ones can be processed satisfactorily. Author

N86-23768# Joint Publications Research Service, Arlington, Va.
USSR REPORT: MACHINE TOOLS AND METALWORKING EQUIPMENT
21 Mar. 1986 71 p Transl. into ENGLISH from various Russian articles
(JPRS-UMM-86-007) Avail: NTIS HC A04/MF A01

The development of machine tools and metal working equipment in the Soviet Union is reported. The following topics are discussed: industry planning and economics, metal cutting and metal forming machine tools, other metal working equipment, automated lines and aggregated machining systems, and robotics. For individual titles, see N86-23769 through N86-23772.

N86-23769# Joint Publications Research Service, Arlington, Va.
PRODUCTIVITY, COMPONENTS OF AUTOMATED PRODUCTION SYSTEMS VIEWED
V. I. Letsik *In its* USSR Report: Machine Tools and Metalworking Equipment (JPRS-UMM-86-007) 21 Mar. 1986 p 35-38 Transl. into ENGLISH from Pribory i Sistemy Upravleniya (Moscow, USSR), no. 10, Oct. 1985 p 40-41 (For primary document see N86-23768 14-31)
Avail: NTIS HC A04/MF A01

The developmet and expanded use of robotics was initiated to increase labor productivity, ensure stable high quality instruments and necessary safety equipment, and to reduce the cost of products. Robotics was introduced to cold stamping machining, loading and unloading, transport and warehousing, etc. Approximately 200 robots were introduced which replaced 50 people. Robotics and robotized technology applied to industrial plants for automation flexible production systems, increase productivity, quality improvement, and reduction of manpower is discussed.
E.A.K.

N86-23770# Joint Publications Research Service, Arlington, Va.
FLEXIBLE PRODUCTION SYSTEMS
A. D. Chudakov and D. D. Shchetinin *In its* USSR Report: Machine

Tools and Metalworking Equipment (JPRS-UMM-86-007) 21 Mar. 1986 p 39-44 Transl. into ENGLISH from Avtomobilnaya Promyshlennost (Moscow, USSR), no. 11, Nov. 1985 p 4-7 (For primary document see N86-23768 14-31)
Avail: NTIS HC A04/MF A01

Flexible production systems are a technological tool design to automate multiple product line manufacturing. Flexible production systems provide an efficient means of organizing combined equipment operations and bring the production organization nearer to an unmanned arrangement or one requiring a limited number of workers. This is achieved by intensifying and automating manufacturing processes; coordinating the automated processes involved in warehousing and materials transport to maintain a tight production path; and using computers to automate production preparation and production control. The prerequisites for a change to these new production structures include numerical control [NC] tools and machining centers, power connection points for robots, automated conveying and warehousing systems controlled by microelectronic devices and control computer complexes consisting primarily of microprocessor-based units capable of controlling equipment via a direct connection and on a real-time basis. The types of flexible production systems in operation are divided into three groups: (1) flexible automated lines (GAL), (2) flexible production modules (GPM); and (3) flexible production complexes (GPK). E.A.K.

N86-23771# Joint Publications Research Service, Arlington, Va.
ADVANCED MACHINE TOOLS, LOADING SYSTEMS VIEWED
V. I. Kharkov *In its* USSR Report: Machine Tools and Metalworking Equipment (JPRS-UMM-86-007) 21 Mar. 1986 p 45-59 Transl. into ENGLISH from Mekhanizatsiya i Avtomatizatsiya Proizvodstva (Moscow, USSR), no. 11, Nov. 1985 p 5-9 (For primary document see N86-23768 14-31)
Avail: NTIS HC A04/MF A01

The machine-tooling complex built from a revolving lathe and a two-armed robot designed to machine short revolving bodies including parts with curvilinear and threaded surfaces from piece blanks in either small-series or series multiitem production is described. The complex consists of: (1) a model 1V340F30 revolving lathe with a vertical axis of rotation, 8-position revolving head on a cross carriage and an Elektronika NTs-31 on-line control system; (2) a gantry-style two-armed M20-Ts robot with a 20-kilogram (20 x 2) load capacity; and (3) an 8-position indexable blank table, one of whose positions is for initial unloading of finished parts. Subsequently, machined parts are set onto the position into which all of the blanks are unloaded. Complex enclosure allows adjustment and process correction during maintenance and convenient observation of the machining process. E.A.K.

N86-23772# Joint Publications Research Service, Arlington, Va.
TRANSPORT MANIPULATOR REVIEWED **c37**
V. Dzyuba, A. S. Mironenko, L. N. Timoshenko, and V. Ye. Kovtunenko *In its* USSR Report: Machine Tools and Metalworking Equipment (JPRS-UMM-86-007) 21 Mar. 1986 p 60-63 Transl. into ENGLISH from Mekhanizatsiya i Avtomatizatsiya Proizvodstva (Moscow, USSR), no. 11, Nov. 1985 p 13-14 (For primary document see N86-23768 14-31)
Avail: NTIS HC A04/MF A01

Floor type transportation facilities for operational servicing of work positions, located on the line with intermediate products, fixtures and tools, make the most frequent use of cart-robots (transmanipulators) are described. The transport manipulator and the warehouse stacker move the same load in flexible production complexes, and it is recommended to have the manipulator grip in the shape of a lifting telescopic bracket moving to both sides, similar to the stacker. The manipulator does the following operations; carries packing to the work position, returns packing to the warehouse and exchanges it. In the exchange packing mode the manipulator operates in the following sequence: on a signal it obtains the packing or a satellite at the warehouse. This is determined by the production operation plan, and moves the load to the exchange table. E.A.K.

N86-23773# Joint Publications Research Service, Arlington, Va.
JAPAN REPORT: SCIENCE AND TECHNOLOGY
25 Mar. 1986 63 p Transl. into ENGLISH from various Japanese articles
(JPRS-JST-86-007) Avail: NTIS HC A04/MF A01

Progress in Japanese science and technology is reported. Topics discussed include: aerospace sciences, biotechnology, metallurgical industry, and new materials. For individual titles, see N86-23774 through N86-23777.

N86-23774# Joint Publications Research Service, Arlington, Va.
ROLLOUT OF XT-4 INTERMEDIATE CLASS TRAINING AIRCRAFT **c05**
In its Japan Report: Science and Technology (JPRS-JST-86-007) 25 Mar. 1986 p 1-5 Transl. into ENGLISH from Aerospace Japan (Tokyo, Japan), Jun. 1985 p 31-33 (For primary document see N86-23773 14-31)
Avail: NTIS HC A04/MF A01

The completion of an XT-4 intermediate class training aircraft is reported. The XT-4 is a high-performance training aircraft produced entirely in Japan. The work of matching its engine and airframe will begin and the airframe will be subjected to functional tests. It will then be subjected to in-house tests and it will be delivered to the Defense Agency and tested for 2 years. Its scheduled completion is set for 2 years. The XT-4 has excellent flight characteristics at a wide variety of speeds. It is equipped with transonic wings, and the airframe shape is modified. The XT-4 is a training aircraft, and is scheduled to be used for flight training, however, it is an excellent aircraft with performance and characteristics suitable for Japan's needs. It is outstanding for rate of climb and range performance. E.A.K.

N86-23775# Joint Publications Research Service, Arlington, Va.
TRENDS IN TACTILE BIOSENSORS, SMELL-SENSITIVE BIOSENSORS **c35**
Kohei Higuchi, Yoshie Kawana, and Jun Kimura *In its* Japan Report: Science and Technology (JPRS-JST-86-007) 25 Mar. 1986 p 6-17 Transl. into ENGLISH from Bio Industry (Tokyo, Japan), Dec. 1985 p 38-45 (For primary document see N86-23773 14-31)
Avail: NTIS HC A04/MF A01

Biosensors, whch combine substances from living organisms such as enzymes with electrochemical transducers, are considered taste-sensitive biosensors. Touch sensors were analyzed using various pressure-sensitive elements, but no attempts were made to use substances from organisms. The sense of smell is a gase sensor for the body; there are numerous uncertainties about the meaning of smell-sensitive biosensors. Tactile biosensors and olfactor biosensors were examined. Biosensors include sensors directly apply materials extracted from organisms and sensors which copy sensors. E.A.K.

N86-23776# Joint Publications Research Service, Arlington, Va.
DEVELOPMENT, USES OF NEW METAL MATERIALS EXAMINED **c26**
J. Tada *In its* Japan Report: Science and Technology (JPRS-JST-86-007) 25 Mar. 1986 p 18-40 Transl. into ENGLISH from Nikko Materials (Tokyo, Japan), Aug. 1985 p 89-100 (For primary document see N86-23773 14-31)
Avail: NTIS HC A04/MF A01

Superconductive metals (alloys) are discussed. The critical temperature (Tc) and the coercive magnetic field (Hc) are examined. Superconductivity is best utilized when Tc and Hc are high. Types and characteristics of superconductive metal materials, the development, and application of superconductive materials (such as alloys) are outlined. Market trends of new metal materials are investigated. E.A.K.

N86-23777# Joint Publications Research Service, Arlington, Va.
PRESENT STATUS AND PROSPECTS OF FINE CERAMICS **c27**
Eiji Kamijo *In its* Japan Report: Science and Technology (JPRS-JST-86-007) 25 Mar. 1986 p 41-57 Transl. into ENGLISH

from Kino Zairyo (Tokyo, Japan), Jul. 1985 p 14-23 (For primary document see N86-23773 14-31)
Avail: NTIS HC A04/MF A01

The ceramic industry has managed to meet the demand by applying a highly controlled process using refined raw materials of high purity. As a result, nonoxide base ceramics such as a nitrogeneous compound, carbide and boride, which do not occur in nature, have become new substances in addition to the existing oxide base ceramics. The existing ceramics using natural mineral raw materials, including porcelain, are called classic ceramics or traditional ceramics. The ceramics using refined artificial raw materials, whose characteristics are highly controlled, are called new ceramics or fine ceramics. High performance ceramics or advanced ceramics are important basic materials for staining advanced technologies. The application of the unlimited potential of fine ceramics as new materials which contribute to technological innovation in the next generation are outlined. The fine ceramics will contribute to the development of the electronics industry. The fine ceramics are considered to have for reaching technological effects and will fill needs in damage resistant materials required for advanced industries, activation of existing industries, and saving of energy and rare metal resources. E.A.K.

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

N86-23778 Pennsylvania State Univ., University Park.
DETECTION OF VLF AND ELF LONG-PATH SIGNALS RADIATED FROM HEATED AND MODULATED IONOSPHERE CURRENT SYSTEMS Ph.D. Thesis
Ray James Lunnen, Jr. 1985 178 p
Avail: Univ. Microfilms Order No. DA8524828

The theoretical and experimental evidence of verified detection of very low frequency (VLF) and extremely low frequency (ELF) long-path signals radiated from a heated and modulated dynamo current system at mid-latitudes are described. A general background of the ionosphere current systems and prior research in VLF/ELF communications is followed by a complete description of the receiving subsystem. The on/off method of ionospheric heating with synchronous detection is the primary experimental technique. Phase reversal of the heating modulation envelope to create four-bit messages with synchronous averaging of the detected message is explained. The amplitude spectrum of background noise was compared to the amplitude spectrum of signal plus noise. All amplitudes were related to the magnitude of the horizontal component of the Earth's magnetic field, and the system detection threshold. Characterization of synchronously averaged four-bit messages at 1838.235 Hz detected locally at Los Canos, Puerto Rico is described. Study and analysis of similar messages in relation to the receiving system detection threshold is presented. Future research is suggested which is designed to further understand the promising communication potential displayed by experimental results. Dissert. Abstr.

N86-23779 Department of the Air Force, Washington, D.C.
DIPOLE RING ARRAY ANTENNA FOR CIRCULARLY POLARIZED PATTERN Patent
Douglas K. Waineo and Sam S. Wong, inventors (to Air Force) Issued 26 Nov. 1985 9 p Supersedes AD-D010881
(AD-D012075; US-Patent-4,555,708; US-Patent-Appl-SN-569642; US-Patent-Class-343-799) Avail: US Patent and Trademark Office CSCL 17/7

A NAVSTAR satellite has a navigation antenna array beamed toward the Earth. A communications antenna array for communicating with other satellites requires a pattern null near the axis and high gain to the sides with pattern null near the axis and high gain to the sides with minimum losses. This is achieved with a dipole ring array comprising eight elements surrounding the navigation array. The ring has a diameter of 1.1 wavelength, and is fed with equal amplitudes and a third mode phase progression, which produces good circular polarization in the far field. For a different sized dipole ring, there will still be an optimum phase distribution which will give good circularly polarized patterns. GRA

N86-23780 Deutsche Geodaetische Kommission, Munich (West Germany).
USE OF DISPERSION FOR ELECTROMAGNETIC DISTANCE MEASUREMENT Ph.D. Thesis - Technische Univ. Munich, West Germany [ZUR AUSNUTZUNG DER DISPERSION FUER DIE ELEKTROMAGNETISCHE STRECKENMESSUNG]
Wolfgang Huebner Bayerischen Akademie der Wissenschaften 1985 109 p refs In GERMAN; ENGLISH summary
(SER-C-310; ISBN-3-7696-9360-4; ISSN-0065-5325) Copyright. Avail: Issuing Activity

The possibilities of dispersion measurement with distance measuring equipment not conceived for this purpose are discussed. The atmospheric influence on the propagation velocity of emitted signals has to be determined for distance measurement using electromagnetic waves. The use of the dispersion reduces difficulties in getting the meterological parameters which are valid for the whole ray path. Equations for the calculation of distances are given, and possible sources of errors are analyzed. Modifications to the equipment allow the application of the two-wavelength method (two-color distance measurement). Author (ESA)

N86-23781*# Ohio State Univ., Columbus. ElectroScience Lab.
BROADCASTING SATELLITE SERVICE SYNTHESIS USING GRADIENT AND CYCLIC COORDINATE SEARCH PROCEDURES
Charles H. Reilly, Clark A. Mount-Campbell, David J. Gonsalvez, Clarence H. Martin, Curt A. Levis, and Cou-Way Wang Feb. 1986 39 p refs
(Grant NAG3-159)
(NASA-CR-176708; NAS 1.26:176708; TR-716548-4) Avail: NTIS HC A03/MF A01 CSCL 17B

Two search techniques are considered for solving satellite synthesis problems. Neither is likely to find a globally optimal solution. In order to determine which method performs better and what factors affect their performance, we design an experiment and solve the same problem under a variety of starting solution configuration-algorithm combinations. Since there is no randomization in the experiment, we present results of practical, rather than statistical, significance. Our implementation of a cyclic coordinate search procedure clearly finds better synthesis solutions than our implementation of a gradient search procedure does with our objective of maximizing the minimum C/I ratio computed at test points on the perimeters of the intended service areas. The length of the available orbital arc and the configuration of the starting solution are shown to affect the quality of the solutions found.
Author

N86-23782# Naval Research Lab., Washington, D. C.
TEXT-DEPENDENT SPEAKER VERIFICATION USING VECTOR QUANTIZATION SOURCE CODING Memorandum Report, Oct. 1984 - Jun. 1985
D. K. Burton 26 Nov. 1985 21 p
(AD-A161875; NRL-MR-5662) Avail: NTIS HC A02/MF A01 CSCL 17/2

Several vector quantization approaches to the problem of text-dependent speaker verification are described. In each of these approaches, a source codebook is designed to represent a particular speaker saying a particular utterance. Later, this same utterance is spoken by a speaker to be verified and is encoded in the source codebook representing the speaker whose identity was claimed. The speak is accepted if the verification utterance's quantization distortion is less than a prespecified speaker-specific threshold. The best of the approaches achieved a 0.7% false acceptance rate and a 0.6% false rejection rate on a speaker population containing 16 admissible speakers and 111 casual

imposters. The approaches are described, and detailed experimental results are presented and discussed. GRA

N86-23783# Royal Signals and Radar Establishment, Christchurch (England).
AN INVESTIGATION OF SYNTHETIC APERTURE RADAR AUTOFOCUS
I. P. Finley and J. W. Wood Apr. 1985 44 p
(AD-A161912; RSRE-MEMO-3790; DRIC-BR-97350) Avail: NTIS HC A03/MF A01 CSCL 17/9

SAR imagery is generated by matched filtering the raw azimuth signal history, assuming uniform straight line motion of the aircraft. Unknown aircraft motions alter the matched filter required for processing. Autofocussing involves determinating from the raw data the appropriate matched filter. In this document the principles of SAR and the requirement for an autofocus system are discussed. Three autofocus methods are investigated: measurement of the power spectrum, contrast maximization, and registration of multilook images. The power spectrum is shown to be unreliable as an autofocus aid. Results of the contract maximisation and registration methods are compared. GRA

N86-23784# Naval Research Lab., Washington, D. C.
A DEMONSTRATION OF SURVEILLANCE-RADAR COMMUNICATION Final Report, Oct. 1981 - Sep. 1984
J. O. Coleman and J. J. Alter 4 Oct. 1985 16 p
(F12-131)
(AD-A161969; NRL-8925) Avail: NTIS HC A02/MF A01 CSCL 17/2

Success in multiplatform sensor integration will require a robust communication capability for transferring data. One way to communicate is to use the existing radar transmitters and antennas. Consequently, the Naval Research Laboratory (NRL) has investigated techniques for radar communications, and has constructed a simple radar communication demonstration system to illustrate a concept suitable both for new radar designs and for retrofitting onto existing radars. GRA

N86-23785# M/A-COM Linkabit, Inc., Vienna, Va.
DSCS (DEFENSE SATELLITE COMMUNICATIONS SYSTEM)/ WIDEBAND SHF (SUPER HIGH FREQUENCY) ENHANCEMENTS AND EHF (EXTREMELY HIGH FREQUENCY) ANTENNA RECOMMENDATIONS FOR THE MID-(1986 - 1991) AND FAR-TERM (1992 - 2000) PERIODS. PART 2 Final Report, 30 Apr. - 30 Nov. 1985
L. Ricardi 29 Nov. 1985 132 p
(Contract DCA100-84-C-0009)
(AD-A162116; DCA/MSO-85-3-Pt-2) Avail: NTIS HC A07/MF A01 CSCL 17/2

The primary purpose of this effort is to examine SHF modifications to DSCS/Wideband systems for all users in the mid (1986 to 1991) and far-term period (1992 to 2000). This report consists of two parts. Part 1 summarizes the recommendation for further study provided by the SHF Working Group during the July through November 1985 period. Part 1 also includes preliminary examination of the benefits of high power amplifier linearization techniques. Part 2 of this document provides detailed analysis and recommendations on the implementation and potential benefits of SHF frequency reuse through polarization diversity. Author (GRA)

N86-23786# Connecticut Univ., Storrs. Dept. of Technical Engineering and Computer Science.
AN EFFICIENT RANDOM ACCESS ALGORITHM FOR PACKET BROADCAST CHANNELS WITH LONG PROPAGATION DELAYS
M. Georgiopoulos, L. Merakos, and P. Papantoni-Kazakos Nov. 1985 38 p
(Contract N00014-85-K-0547; Grant NSF ECS-81-19885)
(AD-A162152; UCT/DEECS-TR-85-9) Avail: NTIS HC A03/MF A01 CSCL 17/2

This paper introduces and analyzes an efficient algorithm for the random accessing of a broadcast channel by a large number of packet-transmitting, bursty users. The algorithm uses a minislot overhead, per packet, to extract detailed information regarding possible packet collisions. In the event of a collision, this information is used by the algorithm for accelerating the collision resolution process. The maximum stable throughput and the mean packet delay induced by the algorithm are evaluated via a systematic analysis method. The packet delay characteristics indicate that the proposed algorithm is well suited for operation on satellite channels, over a wide range of input traffic rates. Author (GRA)

N86-23787# Regis Coll., Weston, Mass.
PHYSICS OF NATURAL AND HF - INDUCED IONOSPHERIC DISTURBANCES AND THEIR EFFECTS ON RADIO COMMUNICATION Final Report, 1 Feb. 1983 - 30 Jun. 1985
Min-Chang Lee 30 Jun. 1985 86 p
(Contract F19628-83-K-0024)
(AD-A162159; AFGL-TR-85-0163) Avail: NTIS HC A05/MF A01 CSCL 17/2

We report a theoretical study of ionospheric disturbances caused by either natural or man-made processes. Thirteen papers published in either technical journals or conference proceedings are compiled in this report, These papers discuss: (1) the identification of the sources of free energy, the optimum conditions for plasma instabilities as the courses of naturally occurring ionospheric irregularities, and (2) the nonlinear effects leading to the HF ionospheric disturbances such as lower hybrid waves, upper hybrid waves, ionospheric irregularities, and geomagnetic field fluctuations. GRA

N86-23788# Naval Underwater Systems Center, Newport, R.I.
FIRST STEPS IN ESTABLISHING THE NUSC/NAVSEA VIDEO TELECONFERENCING SYSTEM
J. F. Griffin and R. G. Heroux 10 Sep. 1985 17 p
(AD-A162259; NUSC-TD-6448) Avail: NTIS HC A02/MF A01 CSCL 17/2

The initial steps taken by the Naval Underwater Systems Center (NUSC) to bring a three-site video teleconferencing system from the concept stage through approval and design to the stage of user development and incipient use are explained. The video conferencing system, due to be operational in October 1985, will link three sites: NUSC laboratories in Newport, R.I., and New London, Conn., and the Naval Sea Systems Command headquarters in Arlington, Virg. This document is intended as a guide to those considering the development of video teleconferencing systems and those planning to submit proposals for such systems. GRA

N86-23789# Naval Postgraduate School, Monterey, Calif.
FINLINE HORN ANTENNAS M.S. Thesis
Mumtaz ULHaq Sep. 1985 124 p
(AD-A162279) Avail: NTIS HC A06/MF A01 CSCL 09/1

This thesis presents the results of an experimental investigation of the finline horn antennas. Both near-field and far-field measurements were made for horns with different physical and electrical parameters. This revealed the influence of the various parameters on the radiation pattern and led to a design which appears to be close to the optimum with respect to gain and sidelobe levels. The application of these horns in a printed circuit monopulse comparator is also demonstrated. GRA

N86-23790# Naval Postgraduate School, Monterey, Calif.
A PERFORMANCE EVALUATION MODEL FOR THE STOCK POINT LOGISTICS INTEGRATED COMMUNICATION ENVIRONMENT (SPLICE) M.S. Thesis
Jonathan B. Schmidt Sep. 1985 69 p
(AD-A162313) Avail: NTIS HC A04/MF A01 CSCL 15/5

This thesis investigates ways of improving the real-time performance of the Stockpoint Logistics Integrated Communication Environment (SPLICE). Performance evaluation through continuous monitoring activities and performance studies are the principle vehicles discussed. The method for implementing this performance evaluation process is the measurement of predefined performance indexes. Performance indexes for SPLICE are offered that would measure these areas. Existing SPLICE capability to carry out

performance evaluation is explored, and recommendations are made to enhance that capability. GRA

N86-23791# Florida Univ., Gainesville. Dept. of Civil Engineering.
WHY A NETWORK ENERGY MONITORING AND CONTROL SYSTEM? M.S. Thesis
Robert B. Barron 1985 155 p
(AD-A162932) Avail: NTIS HC A08/MF A01 CSCL 13/1

By installing control instructions in a computer and connecting it to each piece of equipment, a building facility operator can use the computer to consistently implement control strategies pertaining to utility consumption. This essentially is what is known as an Energy Monitoring and Control System (EMCS). Typically, the building owner insists that the reduction in utility costs after the few years exceeds, or pays back, the installation cost of the EMCS. Due to the high cost of minicomputer equipment, early systems could only have one computer that was remoted through a communications network to many nearby buildings. However, inexpensive but capable microcomputers are available that can provide control for a single building. This report explores the desireability and cost of an EMCS system in general and of these two alternatives in particular. It is found that the quickest payback was found in systems implementing the fewest number of control strategies. Further, it appears that choice of a network over a single building control system depends on the number of buildings connected. GRA

N86-23792# Texas Univ., Austin. Center for Electromechanics.
PULSED POWER REQUIREMENTS FOR ELECTROMAGNETIC LAUNCHES
W. F. Weldon and H. H. Woodson 1986 4 p Presented at the 2nd IEEE Symposium, Electromagnetic Launch Technology, Boston, Mass., 11-14 Oct. 1983 Previously announced in IAA as A84-32001
(AD-A163080; PR-20) Avail: NTIS HC A02/MF A01 CSCL 19/6

Both linear (railgun) and coaxial (mass driver, etc.) electromagnetic launchers (EMLS) are treated as time-varying impedances to determine the relationships between acceleration force, payload velocity, and power supply voltage and current. These relationships are then examined in the light of electromagnetic parameters associated with each EML type ot establish a basis for determining and comparing power supply requirements for various EMLs. GRA

N86-23793# Naval Research Lab., Washington, D. C.
ADAPTIVE CANCELLER LIMITATIONS DUE TO FREQUENCY MISMATCH ERRORS Interim Report
Karl R. Gerlach 2 Jan. 1986 35 p
(AD-A163122; NRL-8949) Avail: NTIS HC A03/MF A01 CSCL 17/9

The effects of frequency mismatch errors on adaptive cancellers are investigated. Frequency mismatch errors occur because of errors in the synthesis process of the bandpass filters designed to be identical which are in each input channel. These frequency mismatches among the channels result in cancellation degradation. Tapped delay line transversal filters can be used to compensate for these frequency mismatches and thus improve cancellation performance. A pole/zero error model of the filters is developed whereby closed form solutions of the maximum achievable cancellation are obtained. This cancellation is a function of the order of the ideally matched frequency filters, the number of time delay taps in the compensating transversal filter, the bandwidth-tapped time delay product, and the constraints on these parameters. A design procedure is outlined for optimizing the canceller with respect to these parameters and their constraints. Specifically, results are presented for when the input filters are the Butterworth type. It is shown that an arbitrarily low output noise residue cannot be achieved by arbitrarily increasing the number of time delay taps. GRA

N86-23794# M/A-COM Linkabit, Inc., Vienna, Va.
INTEROPERABLE COMMERCIAL SATELLITE SYSTEM (ICSS) SPECIFICATION Draft Report, No. 168, Sep. - Nov. 1985
R. Carestio, J. Shattuck, G. Al-Kinani, and P. Chapell Nov. 1985 87 p
(Contract DCA100-84-C-0009)
(AD-A163130; AD-F630622) Avail: NTIS HC A05/MF A01 CSCL 17/2

This top-level system specification establishes the performance, design, development, and test requirements for an Interoperable Commercial Satellite System consisting of large C-band satellite assets with CONUS coverage. The purpose of the system is to augment the Public Switched Network in a post-nuclear attack environment. A separately bound appendix contains specific site information. GRA

N86-23795# Department of the Navy, Washington, D. C.
ADAPTIVE DOPPLER FILTER BANKS Patent Application
Bernard L. Lewis, inventor (to Navy) Filed 19 Aug. 1985 17 p
(AD-D012059; US-Patent-Appl-SN-767205) Avail: NTIS HC A02/MF A01 CSCL 17/9

A radar system for cancelling radar clutter with a minimum of equipment comprising an N-point Fast Fourier Transform for dividing the radar's Doppler space into N contiguous frequency subbands; a delay line disposed at each frequency output port for the FFT for obtaining a set of M+1 consecutive samples from each subband, with the sampling performed at the radar's pulse repetition rate divided by N; a single M degree-of-freedom adaptive canceller moving-target indicator; and M+1 commutating switches for consecutively applying different sets of M+1 subband samples to the MTI. This operation permits clutter cancellation in each subband with N different frequency zeros placed in the radar's Doppler space for each MTI degree-of-freedom. GRA

N86-23796# Sandia National Labs., Albuquerque, N. Mex.
TRANSIENT RESPONSE OF AN INFINITE WIRE IN A DISSIPATIVE MEDIUM
K. C. Chen Aug. 1985 48 p
(Contract DE-AC04-76DP-00789)
(DE86-003966; SAND-85-1096) Avail: NTIS HC A03/MF A01

Currents on a buried wire due to both a localized voltage source and a normal incident wave from above an air-ground interface are calculated using a theory developed earlier. The diffusion limit is carried out to give the following: (1) universal curves for numerical applications, and (2) the effect of an air-ground interface. DOE

N86-23797# Sandia National Labs., Albuquerque, N. Mex.
TRANSIENT RESPONSE OF AN INFINITE CYLINDRICAL ANTENNA IN A DISSIPATIVE MEDIUM
K. C. Chen May 1985 57 p
(Contract DE-AC04-76DP-00789)
(DE86-004230; SAND-85-1077) Avail: NTIS HC A04/MF A01

The transient response of an infinite cylindrical antenna in a dissipative medium to an impulse excitation is calculated via an exact solution in the form of definite integrals and a simple, accurate asymptotic formula. The transmission line solution is shown to be a limiting case of the exact solution. By-products of this study include extension of a general asymptotic method to a more complicated integral and evaluation of a new definite integral. DOE

N86-23798# Construcciones Aeronauticas S.A., Madrid (Spain). Space and Systems Div.
CONFORMAL ARRAY ANTENNA SUBSYSTEM Final Report
Paris ESA 25 Apr. 1985 148 p refs Prepared in cooperation with Instituto de Electronica de Comunicaciones, Madrid, Spain
(Contract ESA-5824/84-NL-PP(SC))
(CASA-ES-85/I-004/E/AR; ESA-CR(P)-2124) Avail: NTIS HC A07/MF A01

An antenna subsystem to communicate between Ariane 4 and a data relay satellite was studied, concluding that the original ideas on ring antennas should be corrected due to the wide margin of coverage required in elevation for such antennas, which implies the need of splitting the coverage. Nevertheless, the study of

cylindrical and conical conformal arrays was continued in view of their intrinsic interest. Needed coverages with specified gain can be obtained with a set of microstrip circular patch antennas. For the lower stage, a single patch is enough. For geostationary missions, one horizontal array is used, and for heliosynchronous missions two horizontal arrays and a vertical one. The numerical study carried out on omniazimuthal ring antennas shows that a tendency to omnidirectional pattern exists in spite of the directivity of the elementary radiators. A small pointing improvement of the meridian pattern can be obtained by means of conical arrays instead of the cylindrical ones. Author (ESA)

N86-23799# Thomson-CSF, Montreuil (France). Div. Composants Microonde.
COMMUTATION ASSEMBLY FOR ERS-1, PHASE 2 Final Report
G. Baran Paris ESA 22 Feb. 1985 99 p In FRENCH
(Contract ESTEC-5703/83-NL-PP)
(Rept-GB/NT-85.5095; ESA-CR(P)-2128) Avail: NTIS HC A05/MF A01

The static and dynamic characteristics of a switching system for the ERS-1 satellite are described. The selected device, working at 5,3 GHz, includes a polarizing magnetic field supplied by an electromagnet with a silica protected gap. A model to work with 400 W average power, and 140 microsec pulses was built. The measured performance indicates a commutation time < 0.001 sec. The dielectric gap and the choice of a ferromagnetic material, adapted to long pulses, results in greater losses, yet compatible with the overall specification. Improvements and overall system design are discussed. Author (ESA)

N86-23800# National Bureau of Standards, Boulder, Colo. Center for Electronics and Electrical Engineering.
TRANSPARENT METROLOGY OF SIGNAL TO NOISE RATIOS OF NOISY BAND-LIMITED DIGITAL SIGNALS
D. Halford Jun. 1985 32 p
(PB86-105277; NBS/TN-1077) Avail: NTIS HC A03/MF A01 CSCL 17B

The author propose the use of a template method for quantitative, correct, and transparent measurement of signal power to additive noise power ratios (SNR) of digital signals and systems under full operating conditions. The author discusses the significance of transparent metrology, the measurement of various SNR's by the template method, and the general applicability of the template method for measurements on any noisy digital signal. The template method can provide transparent metrology procedures for other basic measurands, e.g., intersymbol interference, multiplicative noises, and synchronization. Author (GRA)

N86-24528*# University of Southern Mississippi, Hattiesburg. Dept. of Engineering Technology.
AUTOMATION OF ELECTROMAGNETIC COMPATABILITY (EMC) TEST FACILITIES
Cecil A. Harrison *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 17 p refs (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 20N

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics.*

N86-23801 Department of the Air Force, Washington, D.C.
ELEVATED TRANSIENT TEMPERATURE LEAK TEST FOR UNSTABLE MICROELECTRONIC PACKAGES Patent
Harold Goldfarb, Kenneth L. Perkins, and Bernard L. Weigand, inventors (to Air Force) Issued 19 Nov. 1985 5 p Supersedes AD-D010494
(AD-D012078; US-Patent-4,553,435; US-Patent-Appl-SN-515240; US-Patent-Class-73-40.7) Avail: US Patent and Trademark Office CSCL 09/1

A novel method and apparatus for detecting leaks in glass-to-metal seals of microelectronic devices and the like are described which comprise a double-gasketed vacuum station including a base plate having a central hole an a first gasket for exposing one side of the seals to a leak detector; a vacuum fixture surrounding the device provides a marginal region therearound which can be evacuated to prevent helium from permeating the first gasket; the vacuum fixture includes a central opening to expose the other side of the seals to a helium containing atmosphere within a shroud enclosing the device and vacuum fixture; a second gasket provides a seal between the vacuum fixture and device periphery at the central opening in the fixture. For leak tests under controlled time/temperature conditions, an adjacent infrared lamp is used to radiantly heat the package containing the glass-to-metal seals, and a mask is included to avoid direct radiant heating of the gaskets and glass-to-metal seals. GRA

N86-23802 Department of the Air Force, Washington, D.C.
CHARGE-COUPLED DEVICE GAUSSIAN CONVOLUTION METHOD Patent
Jay P. Sage, inventor (to Air Force) Issued 26 Nov. 1985 6 p Supersedes AD-D011755
(AD-D012080; US-Patent-4,555,770; US-Patent-Appl-SN-541820; US-Patent-Class-364-819) Avail: US Patent and Trademark Office CSCL 09/5

A Gaussian convolution is produced in a CCD imager or shift register by a method involving a special clocking sequence. The principle of operation, analagous to the process of diffusion, involves the deliberate intermixing of adjacent charge packets in a controlled way. Amounts of charge are exchanged between adjacent pixels a number of times, the result approximating the convolution of the image with a Gausian function whose width is dependent upon the number of mixing cycles. GRA

N86-23803# Rome Air Development Center, Griffiss AFB, N.Y.
A RATIONALE AND APPROACH FOR DEFINING AND STRUCTURING TESTABILITY REQUIREMENTS Report, Jun. 1983 - Jan. 1985
Jerome Klion Aug. 1985 44 p
(AF Proj. 233-8)
(AD-A162617; RADC-TR-85-150) Avail: NTIS HC A03/MF A01 CSCL 09/3

Testability concepts and requirements are being applied to many Air Force electronic equipment/system development programs. Insufficient guidance exists as to the definition and structure of testability requirements and the interface between such requirements and maintainability, availability, and integrated diagnostics. The purpose of this report is to provide one logical approach and associated guidance to the definition and structure of testability needs and: (1) the relationship of testability to other system parameters; (2) the translation of testability needs to testability requirements; (3) the interpretation of testability terms, concepts and requirements; (4) the structure and scope of testability requirements; (5) and the identification of those factors, constraints and contingencies which must be considered when invoking testability requirements. GRA

N86-23804# Denver Research Inst., Colo.
HUMAN TROUBLESHOOTING IN ELECTRONICS: IMPLICATIONS FOR INTELLIGENT MAINTENANCE AIDS Final Report, Oct. 1984 - Nov. 1985
Robert A. Keller Nov. 1985 28 p
(Contract F33615-82-C-0013)
(AD-A161832; AFHRL-TR-85-34) Avail: NTIS HC A03/MF A01 CSCL 09/5

The purpose of this paper is to synthesize the literature on human troubleshooting in electronics and derive implications for

designing human interfaces for intelligent maintenance aids. After a background and overview, the nature of human troubleshooting performance is examined; particular attention is devoted to the research that delinates the limitations of human troubleshooting abilities. The implications of this research for the development and application of intellligent aids are discussed. Specific considerations for human-systems interfacing that best addresses the nature and needs of human troubleshooting are presented. GRA

N86-23805# Illinois Univ., Urbana. Cognitive Psychophysiology Lab.

A STUDY OF RELAXATION TECHNIQUES FOR THE TRANSIENT ANALYSIS OF DIGITAL CIRCUITS Ph.D. Thesis

Wei-Kong Chia 3 Jun. 1985 154 p

(Contract N00014-84-C-0149)

(AD-A161854; UILU-ENG-85-2203; R-1028) Avail: NTIS HC A08/MF A01 CSCL 09/3

In the VLSI microelectronics era, the cost of the immense CPU time and memory storage for a standard circuit simulator has become prohibitive. In order to achieve dramatic improvement in the performance of the circuit simulator, there are two principal points of departure from the standard simulation approach, namely, tearing decomposition and relaxation decomposition. This research is to study the numerical convergence and stability properties of several of the relaxation algorithms that have been proposed for the simulation of VLSI circuits. The time-point Gauss-Seidel method with prediction, the exploitation of latency and event scheduling algorithms are implemented into a general purpose circuit simulator SLATE-R (a Simulator with Latency and Tearing--Relaxed version). The performance of the SLATE-R program in the analysis of various types of integrated circuit technologies is studied. GRA

N86-23806# Defence Research Establishment Atlantic, Dartmouth (Nova Scotia).

NOVEL METHODS OF DIGITAL PHASE SHIFTING TO ACHIEVE ARBITRARY VALUES OF TIME DELAY

A. Mohammed Sep. 1985 44 p

(AD-A161918; DREA-85/106) Avail: NTIS HC A03/MF A01 CSCL 09/5

In many signal processing applications such as in underwater acoustic array beamforming, the need arises to implement digital phase shifters. Conventional methods of implementation make use of digital interpolation and decimation to derive FIR (Finite-duration Impulse Response) realizations. Such filters, however, are capable of providing delays that are only rational fractions of the unit delay. To obtain delays that are arbitrary factors of the unit delay, two novel methods are presented: the first method makes use of a windowing technique and the second method makes use of a frequency-sampling approach. In both methods the constraint of exactly linear phase is relaxed and the departures from linear phase are kept very small. To ensure that the new phase shifters attain a high level of performance, comprehensive error measures have been developed and applied; these performance measures consists of a normalized rms error, the phase delay error and the group delay error. Moreover, these error measures are applicable to any method of designing digital phase shifters. In addition, for the frequency-sampling designs, the concept of an effective filter length is introduced; this concept takes into account the wrap-around error that arises in fast-convolution signal processing operations. Aside from the presentation of the design procedures and error measures, examples are included to illustrate the salient features of the two new methods. GRA

N86-23807# Naval Research Lab., Washington, D. C.

A CIRCUIT ANALYSIS PROGRAM Memorandum Report, Jan. 1984 - Jan. 1985

M. Raleigh 26 Nov. 1985 30 p

(AD-A161943; NRL-MR-5692) Avail: NTIS HC A03/MF A01 CSCL 09/5

Two versions of a program for analyzing linear, passive electrical circuits are described. The first version is analytic and calculates steady state frequency response, while the second is numerical and calculates complete response to initial conditions and/or forcing functions. Both versions prompt the user to describe the circuit by specifying the number of nodes and the components which interconnect them. Any interconnection of resistors, capacitors and inductors is allowed. Both versions are presently written in IBM PC basic. Author (GRA)

N86-23808# Naval Research Lab., Washington, D. C.

DESIGN OF A 10 GHz, 10 MW GYROTRON Memorandum Report, Aug. 1984 - Jun. 1985

M. E. Read and G. Bergeron 27 Nov. 1985 61 p

(AD-A161968; NRL-MR-5629) Avail: NTIS HC A04/MF A01 CSCL 09/5

A design for a 10 MW, 10 GHz gyrotron with a maximum pulse length of 100 microsec has been described. The design appears without major risks. Two cavities and their respective electron guns have been investigated. The TE (1,4) cavity is more satisfactory when it is examined without regard for mode competition, but is predicted to suffer strongly from this problem. The TE(1,3) cavity may operate satisfactory with suppression of unwanted modes. although prudence indicates that suppression methods be prepared. The gyrotron using this mode should have good efficiency (about 28%) and a margin of safety is power of over 40%. The gun should produce a beam with an acceptable velocity spread, and its operation is predicted to be stable to changes of current and voltage. Therefore, the TE(1,3) mode will be used initially as the operating mode. GRA

N86-23809# Aerospace Corp., El Segundo, Calif. Chemistry and Physics Lab.

PICOSECOND OPTOELECTRONIC MEASUREMENT OF MICROSTRIP DISPERSION

D. E. Cooper 30 Sep. 1985 17 p

(Contract F04701-83-C-0084)

(AD-A161980; TR-0084A(5945-06)-1; SD-TR-85-72) Avail: NTIS HC A02/MF A01 CSCL 09/5

Very short electrical pulses can be produced by optically triggering optoelectronic switches incorporated into microstrip transmission lines. However, microstrip dispersion causes short electrical pulses to broaden and distort as they propagate. Conventional continuous-wave (CW) dispersion measurements on microstrip have been limited to 18-GHz bandwidth. Here we report optoelectronic generation and sampling of electrical pulses with 5-psec temporal resolution and the use of these pulses to probe dispersion effects of the high-frequency microstrip propagation modes. Theoretical calculations of the dispersed pulse shapes were performed. Results confirm the predictions. Fourier analysis of the dispersed pulse shapes yields the microstrip dispersion curve to about 150 GHz. The measured curve is much less dispersive than an approximate analytical dispersion curve, which may be due to the small dimensions of the microstrips used. GRA

N86-23810# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ENERGY CHARACTERISTICS OF SYNCHRONOUS IMPULSE-EXCITED OSCILLATORS WITH RESISTIVE LOAD

G. A. Sipaylov, A. V. Loos, and E. I. Sobko 31 Oct. 1985 17 p Transl. into ENGLISH from Elektrichestvo (USSR), no. 4, Apr. 1983 p 78-80

(AD-A162008; FTD-ID(RS)T-0122-85) Avail: NTIS HC A02/MF A01 CSCL 10/2

For nourishment of pulse users of energy with active type of load and values of energies, measured by ten megajoules, use/application of synchronous impulse-excited oscillators becomes effective. However, for the effective use/application of impulse-excited oscillators during the physical investigations it is necessary to calculate their energy characteristics, which would make it possible to produce the agreement of generator and load, to determine the fundamental parameters of the generatable impulses/momenta/pulses and other operating characteristics. Universal energy characteristics obtained are given on base of solutions of complete system of differential equations of electro-

mechanical transient process of single-phase impulse-excited oscillator with feed of resistive load. GRA

N86-23811# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PROBLEMS OF THE STABILITY OF THE OUTPUT PARAMETERS OF SELF-EXCITED ELECTROSTATIC GENERATORS DURING PROLONGED CONTINUOUS OPERATION
Yu. G. Leleko 31 Oct. 1985 15 p Transl. into ENGLISH from Izvestiya Tomskogo Politekhnicheskogo Instituta imeni S. M. Kirova (USSR), no. 244, 1972 p 24-27
(AD-A162009; FTD-ID(RS)T-0254-85) Avail: NTIS HC A02/MF A01 CSCL 10/2

Small/miniature self-excited electrostatic generators (ESG), whose design concept and fundamental characteristics are described, is intended for continuous operation for several hours for active or capacitive load, whose value for this time is changed over the wide limits. However, the results, described are obtained during the relatively short-term modes/conditions of the work of generator and give representation only about the maximum possibilities of generator. In mode/conditions of continuous prolonged operation, fundamental characteristic, determining the possibility of practical use/application of self-excited generator, is stability of output parameters, i.e., degree of change in voltage/stress and current of load in dependence on operating time of generator. Purpose of this work is explanation of degree of stability of output parameters in mode/conditions of continuous prolonged operation and reasons, which call their change, which will make it possible to refine recommendations regarding construction of self-excited ESG and to determine optimum mode of their operation. GRA

N86-23812# Yale Univ., New Haven, Conn. Dept. of Computer Science.
COUPLED AND DECOUPLED ALGORITHMS FOR SEMICONDUCTOR SIMULATION
Thomas Kerkhoven Dec. 1985 58 p
(Contracts N00014-82-K-0184; DE-AC02-81ER10996)
(AD-A162132; AD-E440307; YALEU/DCS/RR-429) Avail: NTIS HC A04/MF A01 CSCL 12/1

Algorithms for the numerical simulation are analyzed by computers of the steady state behavior of MOSFETs. The discretization and linearization of the nonlinear partial differential equations as well as the solution of the linearized systems are treated systematically. Thus we generate equations which do not exceed the floating point representations of modern computers and for which charge is conserved while appropriate maximum principles are preserved. A typical decoupling algorithm of the solution of the system of pde is analyzed as a fixed point mapping T. Bounds exist on the components of the solution and for sufficiently regular boundary geometries higher regularity of the derivatives as well. T is a contraction for sufficiently small variation of the boundary data. It therefore follows that under those conditions the decoupling algorithm coverges to a unique fixed point which is the weak solution to the system of pdes in divergence form. A discrete algorithm which corresponds to a possible computer code is shown to converge if the discretizaion of the pde preserves the regularity properties mentioned above. A stronger convergence result is obtained by employing the higher regularity for enforcing the weak formulations of the pde more strongly. The execution speed of a modification of Newton's method, two versions of a decoupling approach and a new mixed solution algorithm are compared for a range of problems. The asymptotic complexity of the solution of the linear systems is identical for these approaches in the context of sparse direct solvers if the ordering is done in an optimal way. GRA

N86-23813# ITT Aerospace/Optical Div., Fort Wayne, Ind.
STUDY IN SPURIOUS SENSITIVITY OF ELECTRONICS IN SPACE Final Report, Jan. - Aug. 1984
David M. Yeager 1 Aug. 1985 61 p
(Contract F49620-83-C-0153)
(AD-A162300; AFOSR-85-0983TR) Avail: NTIS HC A04/MF A01 CSCL 09/1

The results of an experimental investigation into the interaction of protons, E = 318 MeV and 132 MeV, with selected multiplier phototubes and silicon photodiodes are presented. The devices were chosen because of their spaceborne applications and previous gamma ray, electron, and lower energy proton measurements. The energies are representative of those expected of particle beam weapons. A discussion of the operation of each device and its expected response to protons is presented. Testing at Los Alamos Meson Physics Facility demonstrated the temporal response of multiplier phototubes to be nanoseconds but requires microseconds for decay. Another test at the Harvard Cyclotron Lab. determined the transient response of these sensors to 132 MeV protons in the range of 100,000 to 2 X 10 to the 8th power P/sq cm sec. The response was very nearly linear, but was slightly less for most devices. The radiation sensitivity of each device was calculated as expected. The multiplier phototubes were the least sensitive. Author (GRA)

N86-23814# Martin Marietta Aerospace, Denver, Colo. Engineering Dept.
ADVANCED INVERTER TECHNOLOGY Final Report, Oct. 1982 - Oct. 1985
C. R. Griesbach and R. L. Moser Oct. 1985 186 p
(Contract F33615-82-C-2239)
(AD-A162360; MCR-85-613; AFWAL-TR-85-2065) Avail: NTIS HC A09/MF A01 CSCL 10/2

This report gives the results of all Program tasks for the Advanced Inverter Technology Program. APL has three existing series resonant inverter-based power converters. The control and protection circuits are different for the three units. The purpose of this program was to produce a control and protection architecture and functional circuits that would work with all three power stage topologies. The requirements for the three existing power stages were determined. The three existing control and protection circuits were analyzed. An IC technology study was performed to determine the optimum technology and fabrication method for SRI control and protection circuits. A control and protection architecture utilizing common functional circuits that would work with the three existing topologies as developed and block diagrams drawn. The functional tasks were partitioned into five custom parts. The requirements for the custom parts were described. A study was performed to assess the potential present and future functions for a microprocessor in a series resonant inverter. A packaging and thermal study was performed to investigate the problems associated with space deployment of a 200-kW series resonant inverter. GRA

N86-23815# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECTIVE PARAMETERS OF A CASCADE THERMOPILE
I. A. Rezgol 18 Nov. 1985 10 p Transl. into ENGLISH from Izvestiya Akademii Nauk SSSR, Energetika i Transport (USSR), no. 6, Nov. - Dec. 1969 p 137-140
(AD-A162396; AD-E801225; FTD-ID(RS)T-1114-85) Avail: NTIS HC A02/MF A01 CSCL 20/13

For the description of the working characteristics of a multicascade thermopile equations are proposed which are simple in their mathematical structure, and in which the physical properties of the individual cascades are replaced by effective parameters, giving a concept about the properties of the chain of cascades as a whole. Calculation formulas are given for the calculation of effective parameters based on the results of tests of a cascade thermopile. The physical meaning of the effective parameters is discussed and their interconnection with the properties of the individual cascades is shown. GRA

N86-23816# Clarkson Univ., Potsdam, N.Y.
ENERGY DEPOSITION IN GALLIUM ARSENIDE Final Report
Peter J. McNulty 12 Nov. 1985 19 p
(Contract N00014-84-C-2318)
(AD-A162823) Avail: NTIS HC A02/MF A01 CSCL 09/5

The single-event-upset phenomena in microelectronic circuits with emphasis on those resulting from nuclear reactions induced

by energetic protons is described. The goal is to understand the detailed physical mechanisms leading to SEUs sufficiently to put calculating SEUs on a sound quantitative basis. Previously there was considerable success in predicting the charge generation in well defined slabs of silicon. The purpose of this contract was to try extending the model and the associated simulation codes to GaAs and to begin the experimental measurements necessary to test them. The Clarkson Nuclear Reaction models were modified to handle proton-induced nuclear reactions in gallium arsenide. The codes were immediately useful in analyzing the significance that the edge-effect phenomena, discovered in microbeam studies of GaAs gates, would play in increasing the SEU rates for GaAs memories. Techniques were developed using these codes for calculating SEU rates for select circuits flown in space (9). Two of these circuits, the 2901B and the 93L422 are responsible for SEU problems aboard US satellites. Charge-Collection Measurements have been carried out using the GaAs Fat-FET test structures from the Rockwell memories. GRA

N86-23817# Naval Research Lab., Washington, D. C.
ANALYTICAL THERMAL ANALYSIS OF THE I-BAND TRANSMITTER REPLACEMENT Final Report
Timothy J. Bennett 15 Nov. 1985 44 p
(AD-A162832; NRL-8929) Avail: NTIS HC A03/MF A01 CSCL 09/5

An L-band transmitter was designed to replace an existing unit. Increased transmitter reliability and increased mean time between failures were of primary concern for the new design. This report details the thermal analysis and design for a transmitter which operates in a sol-air temperature of 110 F (43 C) with zero wind speed. The thermal modeling programs used are Radiation View Factor (RAVFAC) and Systems Improved Numerical Differencing Analyzer (SINDA). The RAVFAC program is supported by a plotting program, Ravplot, and a date reduction program, Colaps. Author (GRA)

N86-23818# Naval Research Lab., Washington, D. C.
THEORY OF MULTICAVITY GYROKLYSTRON AMPLIFIER BASED ON A GREEN'S FUNCTION APPROACH Final Report
A. K. Ganguly, A. W. Fliflet, and A. H. McCurdy 29 Nov. 1985 17 p Previously announced in IAA as A86-17558
(AD-A163099; NRL-8935) Avail: NTIS HC A02/MF A01 CSCL 09/5

Presented is an application of a self-consistent field theory for gyrotrons to a multicavity gyroklystron configuration. The coupled radio frequency field equation and the Lorentz equations are solved in the slow-time scale formulation by using a Green's function technique to satisfy appropriate boundary conditions. An analytical expression for the small signal gain is obtained by successive approximation. The theory has been developed for cylindrical TE sub mnl mode as well as rectangular sub 101 mode. The theory is applied to calculate the small signal performance characteristics of a three-cavity configuration operating with rectangular TE sub 101 mode. GRA

N86-23819# Harvard Univ., Cambridge, Mass. Div. of Applied Sciences.
JOINT SERVICES ELECTRONICS PROGRAM Annual Progress Report, 1 Apr. - 31 Dec. 1985
M. Tinkham 31 Dec. 1985 83 p
(Contract N00014-84-K-0465)
(AD-A163108; APR-99) Avail: NTIS HC A05/MF A01 CSCL 09/5

This annual report of the JSEP (Joint Services Electronic Program) in solid state electronics, quantum electronics, information electronics, control and optimization, and electromagnetic phenomenon is presented. Results of the research to date are summarized and significant accomplishments are discussed. GRA

N86-23820# University of Southern California, Los Angeles. School of Engineering.
JOINT SERVICES ELECTRONICS PROGRAM Annual Report, 1 Apr. - 31 Dec. 1985
William H. Steier 31 Dec. 1985 34 p
(Contract F49620-85-C-0071)
(AD-A163109) Avail: NTIS HC A03/MF A01 CSCL 09/5

This Annual Report summarizes the accomplishments and progress of fourteen research units for research performed during the reporting period under the Joint Services Electronics Program at The University of Southern California. GRA

N86-23821# Aerospace Corp., El Segundo, Calif. Space Sciences Lab.
HEAVY-ION INDUCED SINGLE EVENT UPSETS IN A BIPOLAR LOGIC DEVICE
Wojciech A. Kolasinski, Rokutaro Koga, and David L. Chenette 30 Dec. 1985 25 p
(Contract F04701-85-C-0086)
(AD-A163117; TR-0086(6940-05)-14; SD-TR-85-96) Avail: NTIS HC A02/MF A01 CSCL 09/5

Heavy ion test results for a bipolar logic device of moderate complexity are presented in this report. Such devices required the implementation of special techniques for testing circuits of varying upset sensitivity, and unlike similar MOS devices, present problems with test data interpretation. GRA

N86-23822# Department of the Army, Washington, D. C.
FILTERING TRANSIENT VOLTAGE SUPPRESSION DEVICE ASSEMBLY Patent Application
Leon H. Riley, inventor (to Army) Filed 22 Nov. 1985 7 p
(AD-D012056; US-Patent-Appl-SN-801024) Avail: NTIS HC A02/MF A01 CSCL 09/5

This filtering transient voltage suppression device assembly adequately provides for filtering of electrical noise and transients. It also provides a circuit with reduced parasitic inductance of the voltage suppression device (VSD). It provides for connector units to be mounted in planes at each end of the assembly. This mounting arrangement enables bulkhead mounting of the FTVSDA. Filters and VSD's are connected, in a low parasitic inductance fashion, between leads interconnecting separate connector pins and the body of the device. A mounting plate inside the device provides structure and electrical connections for assembly, as well as easy access. GRA

N86-23823# Department of the Navy, Washington, D. C.
A SCHOTTKY DIODE AND METHOD OF FABRICATION Patent Application
N. A. Papanicolaou, inventor (to Navy) Filed 30 Sep. 1985 15 p
(AD-D012057; US-Patent-Appl-SN-781560) Avail: NTIS HC A02/MF A01 CSCL 09/1

A Schottky diode and method of making same in which a n+ doped layer, an n doped layer and an undoped layer of a semi-insulating material selected from the group consisting of gallium arsenide, aluminum gallium arsenide and indium phosphide is grown consecutively on a semi-insulating substrate made of the same material. A mesa with acute angled sides is etched on the undoped layer to such a depth that the n doped layer is exposed. A Schottky an ohmic contact are then deposited on opposite sides of the mesa. The exposed n layer is then bombarded with protons at normal incidence. GRA

N86-23824# Department of the Navy, Washington, D. C.
TUNABLE MICROWAVE FILTERS UTILIZING A SLOTTED LINE CIRCUIT Patent Application
Carmine Vittoria, inventor (to Navy) Filed 25 Sep. 1985 15 p
(AD-D012062; US-Patent-Appl-SN-780068) Avail: NTIS HC A02/MF A01 CSCL 09/5

A slottled line tunable microwave filter of the type having a metallic layer having slot patterns thereon, and an insulating layer, the filter also including a variable bias D.C. magnetic field source, for imposing a magnetic field on a dielectric junction in the metallic layer, which may be varied to tune the filter resonant frequency. In one embodiment of the invention the slot pattern comprises a first set of slots and a second set of slots. The first set of slots comprises a first slot disposed coincident with a negative x axis

and the second set of slots comprises a second slot disposed coincident with a positive x axis. GRA

N86-23825# Department of the Navy, Washington, D. C.
N-BIT PROPAGATORY ANALOG-TO-DIGITAL CONVERTER SYSTEM Patent Application
Bobby R. Jarrett, inventor (to Navy) Filed 25 Nov. 1981 22 p (AD-D012071; US-Patent-Appl-SN-324895) Avail: NTIS HC A02/MF A01 CSCL 09/5

The application of peristaltic charge-coupled-devices to an analog delay line provides an ultrahigh speed n-bit propagatory analog-to-digital converter system. The system also includes somewhat unconventional ECL weighted current source digital-to-analog converters. The analog delay line comprised of the peristaltic charge-coupled-devices is clocked in exact synchronism with a digital delay line. Operation at conversion rates above 100MHz are made possible. GRA

N86-23826# Oak Ridge National Lab., Tenn.
USE OF A GENERAL-PURPOSE DEVELOPMENT SYSTEM IN SUPPORT OF A LARGE-SCALE ELECTRICAL DISTRIBUTION CONTROL SYSTEM
G. R. Wetherington, Jr., E. R. Broadaway, and R. R. Bentz 1985 18 p Presented at the International Load Management Conference and Exposition, Chicago, Ill., 9 Dec. 1985
(Contract DE-AC05-84OR-21400)
(DE86-002229; CONF-851215-1) Avail: NTIS HC A02/MF A01

A software development and testing system is being used to support the operation and experimental utilization of a large-scale electrical distribution automation system. The testing system provides the mechanisms to simulate the characteristics of both the large-scale control system and the electrical distribution system that is being controlled. DOE

N86-23827# General Electric Co., Lenox, Mass. High Voltage Transmission Research Facility.
STUDY OF ELECTRIC FIELD AND ION EFFECTS OF HVDC LINES Technical Progress Report
G. B. Johnson Aug. 1985 101 p
(Contract DE-AC02-80RA-50153)
(DE86-002465; DOE/RA-50133/T1; TPR-9) Avail: NTIS HC A06/MF A01

Characterization of the electrical environment downwind of an HVDC transmission line requires the measurement of the charge carried downwind by low mobility aerosols. Both the bulk parameters of the space charge, such as charge density and electric field, and the micro parameters, such as the aerosol size distribution and the charge distribution on the aerosols, must be measured in order to characterize the space charge. Measurements of the space charge density downwind of the main line at the High Voltage Transmission Research Facility (HVTRF) have been made, for monopolar operation of the line, out to a distance of 300m for several different wind speeds. The measurements and instrumentation are reported in Section 2 of this report. Section 3 describes a preliminary attempt to fit a mathematical predictive formula to the data on the downwind charge densities reported in Section 2. DOE

N86-23828# California Univ., Berkeley. Lawrence Berkeley Lab.
EVIDENCE FOR ROOM TEMPERATURE TUNNELING RECOMBINATION IN AMORPHOUS SILICON
H. Dersch and N. M. Amer Jun. 1985 5 p Presented at the 11th International Conference on Amorphous Semiconductors, Rome, Italy, 2 Sep. 1985
(Contract DE-AC03-76SF-00098)
(DE86-002873; LBL-20185; CONF-8509201-1) Avail: NTIS HC A02/MF A01

Room temperature nonradiative recombination in a-Si:H is directly studied by measuring the thermal expansion of the sample due to the heat released during recombination. The nonradiative lifetime is longest for undoped and shortest for doped material. This is the opposite of the photoconductivity behavior. It is concluded that the recombination rates are decoupled from the free carrier densities which is direct evidence that recombination proceeds via tunneling between localized states even at room temperature. DOE

N86-23829# Los Alamos National Lab., N. Mex.
PROGRESS IN RADIATION IMMUNE THERMIONIC INTEGRATED CIRCUITS
D. K. Lynn, comp. and J. B. McCormick, comp. Aug. 1985 149 p
(Contract W-7405-eng-36)
(DE86-003286; LA-10466-MS) Avail: NTIS HC A07/MF A01

This report describes the results of a program directed at evaluating the thermionic integrated circuit (TIC) technology for applicability to military systems. Previous programs under the sponsorship of the Department of Energy, Office of Basic Energy Sciences, have developed an initial TIC technology base and demonstrated operation in high-temperature and high-radiation environments. The program described in this report has two parts: (1) a technical portion in which experiments and analyses were conducted to refine perceptions of near-term as well as ultimate performance levels of the TIC technology and (2) an applications portion in which the technical conclusions were to be evaluated against potential military applications. This report draws several conclusions that strongly suggest that (1) useful radiation-hard/high-temperature operable integrated circuits can be developed using the TIC technology; (2) because of their ability to survive and operate in hostile environments, a variety of potential military applications have been projected for this technology; and (3) based on the above two conclusions, an aggressive TIC development program should be initiated to provide the designers of future systems with integrated circuits and devices with the unique features of the TICs. DOE

N86-23830# Pacific Northwest Lab., Richland, Wash.
PHYSICAL AND NUMERICAL MODELING OF JOULE-HEATED MELTERS
L. L. Eyler, R. J. Skarda, R. S. Crowder, III, D. S. Trent, C. R. Reid, and D. L. Lessor Oct. 1985 175 p refs
(Contract DE-AC06-76RL-01830)
(DE86-003793; PNL-5491) Avail: NTIS HC A08/MF A01

The Joule-heated ceramic-lined melter is an integral part of the high level waste immobilization process under development by the US Department of Energy. Scaleup and design of this waste glass melting furnace requires an understanding of the relationships between melting cavity design parameters and the furnace performance characteristics such as mixing, heat transfer, and electrical requirements. Developing empirical models of these relationships through actual melter testing with numerous designs would be a very costly and time consuming task. Additionally, the Pacific Northwest Laboratory (PNL) has been developing numerical models that simulate a Joule-heated melter for analyzing melter performance. This report documents the method used and results of this modeling effort. Numerical modeling results are compared with the more conventional, physical modeling results to validate the approach. Also included are the results of numerically simulating an operating research melter at PNL. Physical Joule-heated melters modeling results used for qualiying the simulation capabilities of the melter code included: (1) a melter with a single pair of electrodes and (2) a melter with a dual pair (two pairs) of electrodes. The physical model of the melter having two electrode pairs utilized a configuration with primary and secondary electrodes. The principal melter parameters (the ratio of power applied to each electrode pair, modeling fluid depth, electrode spacing) were varied in nine tests of the physical model during FY85. Code predictions were made for five of these tests. Voltage drops, temperature field data, and electric field data varied in their agreement with the physical modeling results, but in general were judged acceptable. DOE

N86-23831# Fermi National Accelerator Lab., Batavia, Ill.
RABBIT SYSTEM. LOW COST, HIGH RELIABILITY FRONT END ELECTRONICS FEATURING 16 BIT DYNAMIC RANGE
G. Drake, T. F. Droege, C. A. Nelson, Jr., K. J. Turner, and T. K.

Ohska Oct. 1985 7 p Presented at the IEEE Nuclear Science Symposium, San Francisco, Calif., 23 Oct. 1985 Prepared in cooperation with National Lab. for High Energy Physics, Oho, (Japan).
(Contract DE-AC02-76CH-03000)
(DE86-003030; FNAL/C-85/156; CONF-851009-21) Avail: NTIS HC A02/MF A01

A new crate-based front end system has been built which features low cost, compact packaging, command capability, 16 bit dynamic range digitization, and a high degree of redundancy. The crate can contain a variety of instrumentation modules, and is designed to be situated close to the detector. The system is suitable for readout of a large number of channels via parallel multiprocessor data acquisition. DOE

N86-23832# United Kingdom Atomic Energy Authority, Harwell (England). Materials Development Div.
A DESIGN STUDY OF CPV AND BIPOLAR ASSEMBLIES OF NICKEL/HYDROGEN CELL STACKS
T. G. Markin, S. Y. Moss, and D. N. E. Smith Paris ESA Apr. 1985 396 p refs 2 Vol.
(Contract ESTEC-5719/83-NL-AN(SC))
(AERE-G-3349-Vol-2; ESA-CR(P)-2106-Vol-2) Avail: NTIS HC A17/MF A01

A conceptual design of a Common Pressure Vessel (CPV) assembly of nickel/hydrogen cell stacks is described. The design features two 85 Ah cell stacks, giving a capacity of 210 Wh in a cylindrical compostie vessel. The design is estimated to yield a gravimetric energy density of 71 Wh/kg and a volumetric energy density of 85.5 Wh/1 (60 bar), although the significance of the latter figure is qualified. The preference for the two-stack module is largely influenced by the flexibility it allows for battery assembly. A study of bipolar assemblies identified interesting concepts, but no single preference. Simualtions of the thermal performance of both designs for GEO and LEO cycles, against a number of idealized boundary conditions, indicate that the desired operating temperatrue range is maintainable with adequate boundary temperature control. Author (ESA)

N86-23833# National Bureau of Standards, Gaithersburg, Md. Center for Electronics and Electrical Engineering.
DIGITAL METHODS IN WAVEFORM METROLOGY Final Report
Barry A. Bell, ed. Oct. 1985 177 p refs Seminar held in Gaithersburg, Md., 18-19 Oct. 1985
(PB86-134871; NBS/SP-707; LC-85-600591) Avail: NTIS HC A09/MF A01; also available SOD HC as 003-003-02694-8 CSCL 09A

Modern electron instrumentation metrology in the low frequency regime (dc-10 MHz) was discussed in lecture talks and papers. The seminar program was oranized into four main session topics. This special publication contains complete papers providing more technical details of the subjects presented at the seminar. For the sessions on Precision Waveform Synthesis, Precision Waveform Sampling, and Data Converter Characterization, six formal papers are given describing the hardware and software techniques used for developing NBS laboratory standards and apparatus for testing ac sources and voltmeters, phase angle meters, transient waveform recorders, wideband wattmeters, and digital-to-analog and analog-to-digital converters. For the informal session on Instrumentation Metrology, three subsequent papers have been written for publication. These have been included in the Appendices for completeness. For individual titles, see N86-23834 through N86-23842.

N86-23834# National Bureau of Standards, Gaithersburg, Md. Electronic Instrumentation and Metrology Electrosystems Div.
DIGITAL WAVEFORM SYNTHESIS TECHNIQUES
N. Michael Oldham *In its* Digital Methods in Waveform Metrology Oct. 1985 p 1-13 refs (For primary document see N86-23833 14-33)
Avail: NTIS HC A09/MF A01 CSCL 09C

Digital waveform generators provide an economical means for producing stable, high fidelity signals over a limited frequency range. Some theoretical properties and practical limitations are described, with emphasis on sinewave reconstruction. Digital synthesis, however, is particularly suited to the construction of complex waveforms which are extremely difficult to produce by conventional analog means. Instrumentation is commercially available which allows the user to program arbitrary waveforms with 8 to 12 bit resolution at sampling frequencies up to 5 MHz. Author

N86-23835# National Bureau of Standards, Gaithersburg, Md. Electronic Instrumentation and Metrology Electrosystems Div.
PHASE ANGLE STANDARDS AND CALIBRATION METHODS
Raymond S. Turgel *In its* Digital Methods in Wareform Metrology Oct. 1985 p 15-30 refs (For primary document see N86-23833 14-33)
Avail: NTIS HC A09/MF A01 CSCL 09C

Phase angle is one of the quantities that describes the properties of ac circuits. Its measurement is important in a wide variety of applications which include analysis of feedback amplifiers, servo-systems, communications circuits, oscillator and filter circuits, transformer characteristics, and other applications ranging from navigation to power systems and even to plasma physics experiments. Accuracy requirements differ widely for many of these applications, but from the point of view of the standards laboratory, calibration accuracy must be sufficient to handle precision commercial phase-angle meters with typical measurement uncertainties of 0.05 degrees and resolution of 0.01 degrees. Calibration methods and the accuracy thereof are discussed. Author

N86-23836# National Bureau of Standards, Gaithersburg, Md. Electronic Instrumentation and Metrology Electrosystems Div.
CHARACTERIZATION OF WAVEFORM RECORDERS c35
Donald R. Flach *In its* Digital Methods in Waveform Metrology Oct. 1985 p 31-53 refs (For primary document see N86-23833 14-33)
Avail: NTIS HC A09/MF A01 CSCL 14C

Although transient waveform recorders have been in use for more than 15 years, no commonly accepted test procedures were in use for these instruments, particularly for the evaluation of errors associated with dynamic input signals. Within the past few years, however, manufacturers and others have begun to use test methods which involve the application of steady state, repetitive waveforms to evaluate the dynamic performance characteristics of these instruments. Parameters measured with these procedures include quantizing errors, differential linearity errors, integral linearity errors, missing codes, and aperture uncertainty. An advantage of the above method is that a sinusoidal waveform is employed for many of the tests, and these are easily generated and well characterized for frequencies up to 1 MHz. Some disadvantages include the necessity for generating low distortion sine waves at frequencies above 1 MHz, and the difficulty of generating linear ramp-like waveforms with the required linearity at repetition frequencies greater than a fw kilohertz. Several test methods are described. Author

N86-23837# National Bureau of Standards, Gaithersburg, Md. Electronic Instrumentation and Metrology Electrosystems Div.
DUAL-CHANNEL SAMPLING SYSTEMS
Gerard N. Stenbakken *In its* Digital Methods in Waveform Metrology Oct. 1985 p 55-73 refs (For primary document see N86-23833 14-33)
Avail: NTIS HC A09/MF A01 CSCL 09C

The application of dual channel sampling techniques to the measurement of electrical power is described, and, to a lesser extent, so is the application of electrical phase angle measurements. Theoretical relationships are developed for describing these sampling measurements and their associated errors. The procedures that can be used to calibrate such dual channel instruments for these applications are also described. A diagram of the basic dual channel sampling system to be analyzed is given. Author

N86-23838# National Bureau of Standards, Gaithersburg, Md. Electronic Instrumentation and Metrology Electrosystems Div.

DATA CONVERTER TEST METHODS **c60**
T. M. Souders *In its* Digital Methods in Waveform Metrology Oct. 1985 p 75-85 refs (For primary document see N86-23833 14-33)
Avail: NTIS HC A09/MF A01 CSCL 09B

A/D and D/A converters are presentedly being produced in a vast array of types and models, exhibiting a wide range of design approaches, operating speeds, and accuracies for a wide variety of applications. As might be expected, an equally large number of test methods has been developed, with each addressing the measurement of some specific characteristics of one or more of these types or models. The more useful test methods pertinent to the characterization of data converters for use in measurement or control instrumentation applications are reviewed. The focus was narrowed by concentratng mostly on static or quasistatic test methods, partly because relatively few dynamic tst methods have been proposed, and in part because some dynamic test methods are being addressed in other presentations of this seminar. Author

N86-23839# National Bureau of Standards, Gaithersburg, Md. Electronic Instrumentation and Metrology Electrosystems Div.
SETTLING TIME MEASUREMENTS **c70**
Howard K. Schoenwetter *In its* Digital Methods in Waveform Metrology Oct. 1985 p 87-108 refs (For primary document see N86-23833 14-33)
Avail: NTIS HC A09/MF A01 CSCL 20C

Methods of measuring device settling times (STs) from 5 microseconds to less than 20 ns with corresponding accuracies of 1 ppm and 0.1% are described. Most of these methods are thought to represent state-of-the-art techniques, developed at NBS and in industry. Some of the ST measurement methods discussed are described in a March, 1983 paper. Only a brief review of these methods will be given, showing only the salient features. Some of the NBS work has been concerned with measuring thermally induced transients and offsets in devices under test (DUTs). Methods of measuring these effects with ST measuring circuits are described. Author

N86-23840# National Bureau of Standards, Gaithersburg, Md.
AN AUTOMATIC AC/DC THERMAL VOLTAGE CONVERTER AND AC VOLTAGE CALIBRATION SYSTEM
K. J. Lentner, D. R. Flach, and B. A. Bell *In its* Digital Methods in Waveform Metrology Oct. 1985 26 p refs Previously announced in IAA as A85-30304 (For primary document see N86-23833 14-33) (NBSIR-84-2973) Avail: NTIS HC A09/MF A01

An automatic ac/dc difference calibration system is described which uses direct measurement of thermoelement emfs. In addition to ac/dc difference testing, the system can be used to measure some important characteristics of thermoelements, as well as to calibrate ac voltage calibrators and precision voltmeters. The system operates over a frquency range from 20 Hz to 100 kHz, covering the voltage range from 0.5 V to 1 kv. For all voltages the total measurement uncertainties expected (including the uncertainty of the specific reference thermal converters used) were 50 parts per million (ppm) at frequencies from 20 Hz to 20 kHz, inclusive, and 100 ppm at higher frequencies up to 100 kHz.
Author (GRA)

N86-23841# National Bureau of Standards, Gaithersburg, Md. Electronic Instrumentation and Metrology Electrosystems Div.
GALLIUM ARSENIDE (GaAs)-BASED PHOTOCONDUCTIVE SWITCHES FOR PULSE GENERATION AND SAMPLING APPLICATIONS IN THE NANOSECOND REGIME
Barry A. Bell, Arnold G. Perrey, and Robert A. Sadler (ITT Gallium Arsenide Technology Center, Roanoke, Va.) *In its* Digital Methods in Waveform Metrology Oct. 1985 21p refs Presented at the Instrumentation and Measurements Technology Conference, 22 Mar. 1985 Submitted for publication (For primary document see N86-23833 14-33)
Avail: NTIS HC A09/MF A01 CSCL 09A

The design of a set of optoelectronic switches having an interdigitated electrode structure and implemented with high resistivity GaAs photoconductive substrates is described. A theoretical analysis is developed for determining the pulsed light ON state resistance (peak conductance), OFF state (dark) resistance, and the associated capacitances for the various designed gap geometries. Data are provided on the processing steps used in successfully fabrication a working set of switches based on the theoretical design. A test apparatus is used to make measurements of the pulsed light conductance of these devices having nominal gap spacings of 5, 10, 20, and 40 micrometers.
Author

N86-23842# National Bureau of Standards, Gaithersburg, Md. Electrosystems Div.
AN APPROACH TO ATE CALIBRATION VIA PERFORMANCE VERIFICATION AT THE SYSTEM INTERFACE **c70**
Thomas F. Leedy *In its* Digital Methods in Waveform Metrology Oct. 1985 4 p refs Presented at the Measurement Science Conference, 17-18 Jan. 1985 Submitted for publication (For primary document see N86-23833 14-33)
Avail: NTIS HC A09/MF A01 CSCL 20C

A method of verifying the performance of automatic test equipment (ATE) in its normal operating environment and configuration is presented as the best approach to achieving an overall system calibration. The method consists of the transport of well characterized signal sources to the ATE station and the application of these electrical stimuli directly to a well defined electrical interface on the test station. Data is presented on typical accuracies that have been obtained on limited parameters and ranges during the testing process, using calibrated commercial equipment.
Author

N86-24515*# Tuskegee Inst., Ala. Dept. of Electrical Engineering.
INVESTIGATION OF POTENTIAL DRIVER MODULES AND TRANSMISSION LINES FOR A HIGH FREQUENCY POWER SYSTEM ON THE SPACE STATION
Harold T. Brush *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 36 p refs (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 09C

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics.*

N86-23843 Minnesota Univ., Minneapolis.
EFFECT OF SPATIALLY PERIODIC HEATING OR AN ABRUPT CONTRACTION AT INLET ON TRANSITIONAL AND TURBULENT HEAT TRANSFER IN A DUCT Ph.D. Thesis
Alfonso GarciaGutierrez 1985 177 p
Avail: Univ. Microfilms Order No. DA8528811

A three-part investigation of convective heat and mass transfer from a one-sided-heated flat rectangular duct with fully developed transitional and turbulent flow was performed both experimentally and numerically. Quasi-local mass transfer results were obtained via the napthalene sublimation technique. The heat/mass transfer analogy permitted conversion into heat transfer results. First, the duct active wall is held isothermal. Experimental and numerical mass transfer results were generated for Sc = 2.5, supplemented by numerical results for heat transfer to air (Pr = 0.7). Second, the duct active wall is spatially periodically heated (i.e., successive adiabatic and heated segments). Experimental and numerical results were also obtained. Finally, experimental results are obtained for a duct with an unsymmetric contraction of the flow cross section. For the first case, the experimental Sherwood number distributions displayed typical entrance region variations.

The fully developed data agreed very well with well-established correlations. Dissert. Abstr.

N86-23844 State Univ. of New York, Buffalo.
TRANSPORT AND HYDRODYNAMIC STABILITY OF AN EXTENSIVE FLUID SUDDENLY HEATED FROM BELOW Ph.D. Thesis
Hechmi Hamouda 1985 247 p
Avail: Univ. Microfilms Order No. DA8528261

The hydrodynamic stability of the growing conduction layer in an extensive fluid above a horizontal surface has been investigated both analytically and experimentally. The analysis involved a study of the stability of convective flows in the vicinity of a horizontal surface suddenly generating a spatially uniform and time independent heat flux in an extensive fluid. The transport phenomenon occurring next to such a horizontal flat surface is formalized herein in terms of new hydrodynamic stability equations, which constitute a two-point-boundary-value eigenvalue problem. These equations were derived using conservation laws and by assuming that periodic small disturbances are superimposed on a base flow. A simple new dimensionless parameter arose. These stability equations are stiff and were integrated using a computer code designed for especially precise solutions of two-point-value problems. Associated measurements using color Schlieren photography and a data acquisition system were conducted to verify this analysis. Dissert. Abstr.

N86-23845 Minnesota Univ., Minneapolis.
ENDWALL BOUNDARY LAYER, CYLINDER DIAMETER, REYNOLDS NUMBER, AND SURFACE INJECTION EFFECTS ON LOCAL MASS TRANSFER FROM A CYLINDER IN CROSSFLOW Ph.D. Thesis
Jakov Karni 1985 255 p
Avail: Univ. Microfilms Order No. DA8528818

A naphthalene sublimation technique is used to determine the circumferential and longitudinal variations of mass transfer from a smooth circular cylinder in a crossflow of air. The study is divided into two parts. In the first part, the effects of cylinder diameter and endwall boundary layer on the approaching flow are investigated for a cylinder Reynolds number of 10,000-80,000. High transfer coefficients are detected near the base of the cylinder, and enhancement of the mass transfer over values obtained where the flow is two-dimensional is seen up to a distance of 3.5 cylinder diameters from the tunnel wall. It is shown that the spanwise extent of the strip near the cylinder base where high coefficients are observed is proportional to the cylinder diameter. Mass transfer values near the endwall increase rapidly with Reynolds number; they also depend on the ratio of cylinder length to diameter (the aspect ratio) and the ratio of mainstream boundary layer displacement thickness to cylinder diameter. Dissert. Abstr.

N86-23846 Manchester Univ. (England).
TURBULENCE MODELLING OF FLOWS WITH NON-UNIFORM DENSITY Ph.D. Thesis
Jordan M. MacInness 1985 266 p
Avail: Univ. Microfilms Order No. DA8527403

Large differences in flux density may be expected to alter the processes determining turbulent transport. The correct simulation of these alternations is important in many practical flows, notably in turbulent combustion. This thesis examines the problem of modelling non-uniform density turbulence and develops an appropriate second-moment closure. Careful consideration is given to the role of each exact term in the averaged conservation equations and in the equations for the second moment correlations. Where high order terms depending on density gradients or density fluctuations might make a significant contribution, approoriate representations are developed. Several new models are introduced which reflect the effect of density non-uniformity on the pressure scrambling process and on the way fluctuation energy is transferred from large-scale motions where turbulence is produced to the finest scales where it is destroyed. Dissert. Abstr.

N86-23847 Rensselaer Polytechnic Inst., Troy, N.Y.
DEVELOPMENT OF HIGHER ORDER NUMERICAL PROCEDURES FOR THE SOLUTION OF FLUID FLOW AND HEAT TRANSFER EQUATIONS Ph.D. Thesis
Richard James Lounsbury 1985 322 p
Avail: Univ. Microfilms Order No. DA8528664

The objective of this thesis is to develop and analyze two higher order numerical schemes for the solution of fluid flow and heat transfer equations. These schemes are derived on the same theme as the well known exponential differencing scheme. The exponential differencing scheme is based on the locally one-dimensional profile assumption that the total flux (i.e. conduction and diffusion) is constant between grid points. Therefore, if the problem is one-dimensional and the source term in the convection-diffusion equation is equal to zero, the exponential scheme will produce the exact solution. However, most practical problems are multidimensional and involve significant source terms. For such problems, the exponential scheme is generally not very accurate. The first scheme that is developed in this thesis, called LOAD0, is derived on the assumption that the total flux has a linear variation between grid points. The second new scheme, called LOAD1, is derived on the assumption that the total flux has a quadratic variation between grid points. Dissert. Abstr.

N86-23848 Arkansas Univ., Fayetteville.
A STUDY OF THE PLASTIC FLOW AROUND A HARDNESS INDENTATION USING THE FINITE ELEMENT METHOD Ph.D. Thesis
Mahmoud Mosavi-Mashagi 1984 128 p
Avail: Univ. Microfilms Order No. DA8528933

Important mechanical properties governing metal forming processes are yield strength, ultimate tensile strength and uniform elongation, which are usally determined from tensile tests. The relative high costs of tensile tests has resulted in considerable interest in finding alternative methods to evaluate these properties. Hardness testing was suggested as a good alternative, because of its simplicity and low cost. Hardness test results were related to yield stress and ultimate tensile strength. The finite element method is used to study material flow around a hardness indentation and determine analytical correlations between elongation and ductility parameter (h/r) and other material parameters: uniform elongation, yield strength, load and Poisson's ratio. A test piece was modeled and a Nastran computer program was used to obtain numerical solutions to an ideal hardness indentation processes. Dissert. Abstr.

N86-23849 Texas A&M Univ., College Station.
ANALYTICAL AND EXPERIMENTAL INVESTIGATION OF A DUAL PASSAGE, MONOGROOVE HEAT PIPE Ph.D. Thesis
George Paul Peterson 1985 165 p
Avail: Univ. Microfilms Order No. DA8528365

A parametric study of the forces governing the liquid vapor interface as performed for the purpose of determining the capillary priming characteristics of Grumman's dual passage, monogroove heat pipe when subjected to microgravitational conditions. The static liquid-vapor interface configuration was determined through the minimization of the free surface energies and two different mathematical models which described the time to prime were developed. In addition to the priming time modeling, a parametric study of the defining equations which govern the steady state operational characteristics of the heat pipe was completed. These defining equations were combined to form the basis of a model which described the operational and performance characteristics. Two experiments were designed, one testing the priming time when subjected to a microgravity field and one to determine the operational and transport characteristics as a function of the adverse tilt. Data from these experiments were correlated with the modeling predictions in an effort to verify the modeling techniques. Information from these two models, when combined, can be used to predict the maximum heat transport of the heat pipe while, experiencing external accelerations. Dissert. Abstr.

N86-23850 California Univ., Irvine.
A TWO-EQUATION TURBULENCE MODEL FOR FREE AND BOUNDED TWO-PHRASE FLOWS Ph.D. Thesis
Mostafa Abcel-Hamed Taha Aly Rizk 1985 209 p
Avail: Univ. Microfilms Order No. DA8527434

A theoretical investigation of turbulent, free and bounded, two-phase lows has been conducted. The objective is to develop a two-equation turbulence model which accounts for the interaction between the two phase for two-dimensional, isothermal, free and confined turbulent flows. The two equations describe the conservation turbulence kinetic energy and dissipation rate of that energy for the carrier fluid. The suspension is assumed to be dilute. The dispersed phase is assumed to consist of particles spherical in shape and uniform in size. The physical properties of each phase are assumed to be constant. The two conservation equations are rigorously derived from the momentum equations of the carrier fluid. Closure for high Reynolds number turbulence is obtained by modeling the turbulent correlations up to third order. Predictions obtained with the high-Reynolds number closure of the model are in very good agreement with available experimental data for the flow of a turbulent round jet laden with spherical, uniform-size solid particles. Dissert. Abstr.

N86-23851*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ANALYTICAL AND NUMERICAL STUDIES OF THE THERMOCAPILLARY FLOW IN A UNIFORMLY FLOATING ZONE
William W. Fowlis and Glyn O. Roberts (Roberts Associates, Inc., Vienna, Va.) 1986 42 p refs
(NASA-TP-2576; NAS 1.60:2576) Avail: NTIS HC A03/MF A01 CSCL 20D

The microgravity environment of an orbiting vehicle permits crystal growth experiments in the presence of greatly reduced buoyant convection in the liquid melt. Crystals grown in ground-based laboratories do not achieve their potential properties because of dopant variations caused by flow in the melt. The floating zone crystal growing system is widely used to produce crystals of silicon and other materials. However, in this system the temperature gradient on the free sidewall surface of the melt is the source of a thermocapillary flow which does not disappear in the low-gravity environment. The idea of using a uniform rotation of the floating zone system to confine the thermocapillary flow to the melt sidewall leaving the interior of the melt passive is examined. A cylinder of fluid with an axial temperature gradient imposed on the cylindrical sidewall is considered. A half zone and the linearized, axisymmetric flow in the absence of crystal growth is examined. Rotation is found to confine the linear thermocapillary flow. A simplified model is extended to a full zone and both linear and nonlinear thermocapillary flows are studied theoretically. Analytical and numerical methods are used for the linear flows and numerical methods for the nonlinear flows. It was found that the linear flows in the full zone have more complicated and thicker boundary layer structures than in the half zone, and that these flows are also confined by the rotation. However, for the simplified model considered and for realistic values for silicon, the thermocapillary flow is not linear. The fully nonlinear flow is strong and unsteady (a weak oscillation is present) and it penetrates the interior. Some non-rotating flow results are also presented. Since silicon as a large value of thermal conductivity, one would expect the temperature fields to be determined by conduction alone. This is true for the linear and weakly nonlinear flows, but for the stronger nonlinear flow the results show that temperature advection is also important. Uniform rotation may still be a means of confining the flow and the results obtained define the procedure to be used to examine this hypothesis. Author

N86-23852*# Vigyan Research Associates, Inc., Hampton, Va.
DESIGN OF FUSELAGE SHAPES FOR NATURAL LAMINAR FLOW Final Report
S. S. Dodbele, C. P. vanDam, and P. M. H. W. Vijgen (Kansas Univ., Lawrence, Kas.) Washington NASA Mar. 1986 41 p refs
(Contract NAS1-17926)
(NASA-CR-3970; NAS 1.26:3970) Avail: NTIS HC A03/MF A01 CSCL 20D

Recent technological advances in airplane construction techniques and materials allow for the production of aerodynamic surfaces without significant waviness and roughness, permitting long runs of natural laminar flow (NLF). The present research effort seeks to refine and validate computational design tools for use in the design of axisymmetric and nonaxisymmetric natural-laminar-flow bodies. The principal task of the investigation involves fuselage body shaping using a computational design procedure. Analytical methods were refined and exploratory calculations conducted to predict laminar boundary-layer on selected body shapes. Using a low-order surface-singularity aerodynamic analysis program, pressure distribution, boundary-layer development, transition location and drag coefficient have been obtained for a number of body shapes including a representative business-aircraft fuselage. Extensive runs of laminar flow were predicted in regions of favorable pressure gradient on smooth body surfaces. A computational design procedure was developed to obtain a body shape with minimum drag having large extent of NLF. Author

N86-23853*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SIMULATION OF THE TURBULENT RAYLEIGH-BENARD PROBLEM USING A SPECTRAL/FINITE DIFFERENCE TECHNIQUE Final Report
T. M. Eidson (Georgia Inst. of Technology, Atlanta), M. Y. Hussaini, and T. A. Zang Feb. 1986 44 p refs Presented at EUROMECH 199 Direct and Large Eddy Simulation of Turbulent Flows, Munich, Germany, 30 Sep. - 2 Oct. 1985
(Contracts NAS1-17070; NAS1-18107)
(NASA-CR-178027; ICASE-86-6; NAS 1.26:178027) Avail: NTIS HC A03/MF A01 CSCL 20D

The three-dimensional, incompressible Navier-Stokes and energy equations with the Bousinesq assumption have been directly simulated at a Rayleigh number of 3.8 x 10 to the 5th power and a Prandtl number of 0.76. In the vertical direction, wall boundaries were used and in the horizontal, periodic boundary conditions were used. A spectral/finite difference numerical method was used to simulate the flow. The flow at these conditions is turbulent and a sufficiently fine mesh was used to capture all relevant flow scales. The results of the simulation are compared to experimental data to justify the conclusion that the small scale motion is adequately resolved. Author

N86-23854*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LIQUID-VAPOR INTERFACE LOCATIONS IN A SPHEROIDAL CONTAINER UNDER LOW GRAVITY
Michael J. Carney Apr. 1986 27 p refs
(NASA-TM-87147; E-2936; NAS 1.15:87147) Avail: NTIS HC A03/MF A01 CSCL 20D

As a part of the general study of liquid behavior in low gravity environments, an experimental investigation was conducted to determine if there are equilibrium liquid-vapor interface configurations that can exist at more than one location in oblate spheroidal containers under reduced gravity conditions. Static contact angles of the test liquids on the spheroid surface were restricted to near 0 deg. The experiments were conducted in a low gravity environment. An oblate spheroidal tank was tested with an eccentricity of 0.68 and a semimajor axis of 2.0 cm. Both quantitative and qualitative data were obtained on the liquid-vapor interface configuration and position inside the container. The results of these data, and their impat on previous work in this area, are discussed. Of particular interest are those equilibrium interface configurations that can exist at multiple locations in the container. Author

N86-23855*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A SPECTRAL MULTI-DOMAIN TECHNIQUE WITH APPLICATION TO GENERALIZED CURVILINEAR COORDINATES
Michele G. Macaraeg and Craig L. Streett Mar. 1986 25 p refs Prepared for presentation at the 6th International Conference on

Finite Element Methods in Flow Problems, Antibes, France, 16-20 Jun. 1986
(NASA-TM-87701; NAS 1.15:87701) Avail: NTIS HC A02/MF A01 CSCL 20D

Spectral collocation methods have proven to be efficient discretization schemes for many aerodynamic and fluid mechanic problems. The high order accuracy and resolution shown by these methods allows one to obtain engineering accuracy solutions on coarse meshes, or alternatively, to obtain solutions with very small error. One drawback to these techniques was the requirement that a complicated physical domain must map into a simple computational domain for discretization. This mapping must be smooth if the high order accuracy and expontential convergence rates associated with spectral methods are to be preserved. Additionally even smooth stretching transformations can decrease the accuracy of a spectral method, if the stretching is severe. A further difficulty with spectral methods was in their implementation on parallel processing computers, where efficient spectral algorithms were lacking. The above restrictions are overcome by splitting the domain into regions, each of which preserve the advantages of spectral collocation, and allow the ratio of the mesh spacing between regions to be several orders of magnitude higher than allowable in a single domain. Such stretchings would be required to resolve the thin viscous region in an external aerodynamic problem. Adjoining regions are interfaced by enforcing a global flux balance which preserves high-order continuity of the solution, regardless of the type of the equations being solved. Author

N86-23856*# Garrett Turbine Engine Co., Phoenix, Ariz.
DILUTION JET MIXING PROGRAM, SUPPLEMENTARY REPORT
R. Srinivasan and C. White Mar. 1986 397 p refs
(Contract NAS3-22110)
(NASA-CR-175043; NAS 1.26:175043; Rept-21-4705) Avail: NTIS HC A17/MF A01 CSCL 20D

The velocity and temperature distributions predicted by a 3-D numerical model and experimental measurements are compared. Empirical correlations for the jet velocity trajectory developed are presented. The measured velocity distributions for all test cases of phase through phase 3 are presented in the form of contour and oblique plots. quantification of the effects of the following on the jet mixing characteristics with a confined crossflow are: (1) orifice geometry momentum flux ratio and density ratio; (2) nonuniform mainstream temperature and velocity profiles upstream of dilution orifices; (3) cold versus hot jet injection; (4) cross-stream flow are a convergence as encountered in practical dilution zone geometries; (5) 2-D slot versus circular orifices; (6) discrete noncircular orifices; (7) single-sided versus opposed jets; (8) single row of jets. E.A.K.

N86-23857*# Sverdrup Technology, Inc., Cleveland, Ohio.
PREDICTION OF HEAT RELEASE EFFECTS ON A MIXING LAYER Final Report
Mohammed Farshchi Feb. 1986 26 p refs Presented at the 24th Aerospace Science Meeting, Reno, Nev., 6-9 Jan. 1986; sponsored by American Inst. of Aeronautics and Astronautics Previously announced in IAA as A86-22676
(Contract NAS3-24105)
(NASA-CR-175044; E-2845; NAS 1.26:175044) Avail: NTIS HC A03/MF A01 CSCL 20D

A fully second-order closure model for turbulent reacting flows is suggested based on Favre statistics. For diffusion flames the local thermodynamic state is related to single conserved scalar. The properties of pressure fluctuations are analyzed for turbulent flows with fluctuating density. Closure models for pressure correlations are discussed and modeled transport equations for Reynolds stresses, turbulent kinetic energy dissipation, density-velocity correlations, scalar moments and dissipation are presented and solved, together with the mean equations for momentum and mixture fraction. Solutions of these equations are compared with the experimental data for high heat release free mixing layers of fluorine and hydrogen in a nitrogen diluent. Author

N86-23858# Tokyo Univ. (Japan). Inst. of Space and Astronomical Science.
PROCEEDINGS OF THE SYMPOSIUM ON MECHANICS FOR SPACE FLIGHT
Mar. 1985 169 p refs Symposium held in Tokyo, Japan, 8-10 Nov. 1984
(ISAS-SP-3; ISSN-0288-433X) Avail: NTIS HC A08/MF A01

Various topic relative to space flight mechanics are discussed. Vortex interactions, a numerical study of a two-dimensional flow, a simulation of vortices shed behind a rotating wing, gas flow in binary stars, and the development of heat pipes for use in space are among the topics covered. For individual titles, see N86-23859 through N86-23872.

N86-23859# Ochanomizu Women's Univ., Tokyo (Japan).
INTERACTIONS OF VORTICES **c02**
Yuko Oshima *In* Tokyo Univ. Proceedings of the Symposium on Mechanics for Space Flight Mar. 1985 p 3-15 refs (For primary document see N86-23858 14-34)
Avail: NTIS HC A08/MF A01

Interaction of vortex filaments are one of the elementary process taking place in turbulent flow, and some interesting interaction phenomena among them are studied. Firstly, several vortex rings are ejected in series along the same axis into still air through a circular orifice and the interactions of them are experimentally analyzed together with the simple numerical simulation micro-computer using discrete vortex method in which each vortex is represented by seven vortex filaments. Secondly, an elliptic vortex ring is ejected through an elliptic orifice and the deformation of the ring due to the self interaction is followed. Thirdly, two vortex rings are ejected simultaneously from two identical circular orifices separated with a certain distance and their merging, splitting and interchanging are observed. Author

N86-23860# Tokyo Univ. (Japan).
NUMERICAL STUDY OF TWO-DIMENSIONAL VORTEX STREET **c02**
Kazuhiro Tsuboi and Koichi Oshima *In its* Proceedings of the Symposium on Mechanics for Space Flight Mar. 1985 p 17-30 refs (For primary document see N86-23858 14-34)
Avail: NTIS HC A08/MF A01

Two-dimensional Karman type vortex street, which consists of two infinite parallel rows of finite area vortices, is numerically investigated using discrete vortex approximation, in which each vortex is represented by a bundle of a number of point vortices. The numerical experiment was performed for wide range of the initial conditions of the vortex street in order to make clear such characteristic features as the deformation of each vortex, the merging within each row and the formation of secondary vortex street. Also, the result showed that the initial ratio of the transverse-to-longitudinal separations of the vortices must be within 0.3 to 0.5 for stable formation of the secondary vortex street. Author

N86-23861# Nagoya Univ. (Japan). Dept. of Applied Physics.
VORTON MODEL ANALYSIS
Sinzi Kuwabara *In* Tokyo Univ. Proceedings of the Symposium on Mechanics for Space Flight Mar. 1985 p 31-42 refs Sponsored in part by the Ministry of Education, Japan (For primary document see N86-23858 14-34)
Avail: NTIS HC A08/MF A01

The basic equations for the vorton analysis are derived from the cell discretization of the vorticity field. This model analysis is applied to the birst phenomena in the turbulent boundary layer and the entangled two vortex rings. In these calculations, the vortons change continuously in the initial stage from an aligned vorton state, and develop rapidly and independently after that stage. The helicity, which sould be conserved in the inviscid motion, is constant the initial stage, but changes rapidly and strongly after that. Author

N86-23862# Tokyo Univ. (Japan).
NUMERICAL SIMULATION OF VORTICES SHED BEHIND A

ROTATING WING c02

Naoki Izutsu and Hidesada Kanda (IBM Japan, Ltd.) *In its* Proceedings of the Symposium on Mechanics for Space Flight Mar. 1985 p 43-50 refs Sponsored in part by IBM Japan, Ltd. (For primary document see N86-23858 14-34)

Avail: NTIS HC A08/MF A01

The vortices shed behind a 15%-thick, two dimensional elliptic cylinder rotating around its spanwise axis perpendicularly to a uniform flow were numerically analyzed using discrete vortex-blob method. The color coded vorticity distributions in the flow field were displayed in both cases of the forced and autorotation. Moreover, a 16 mm animation movie of it was made to visualize vortex interactions. By means of this color graphic simulation, the merging rearrangement, interaction and splitting of the vortices in the wake flow of a rotating wing were demonstrated making these processes clearly understandable. Author

N86-23863# Kyoto Univ. (Japan). Dept. of Aeronautical Engineering.

NUMERICAL SIMULATIONS IN COSMIC GAS DYNAMICS: GAS FLOWS IN BINARY STARS c90

Takuya Matsuda *In* Tokyo Univ. Proceedings of the Symposium on Mechanics for Space Flight Mar. 1985 p 51-66 refs Sponsored in part by the Ministry of Education, Science and Culture, Japan (For primary document see N86-23858 14-34)

Avail: NTIS HC A08/MF A01

Examples of numerical simulation in cosmic gasdynamics, i.e. gas flows in close binary stars, are presented. The first example is a calculation of Roche lobe overflow in a semidetached binary system. The second one is an interaction of stellar wind blowing from the mass losing star with another star. The third example is a mass loss from a contact binary system. Finite difference schemes are used to calculate gas flows. In either cases shock waves are formed because of gravitational focusing effect. Author

N86-23864# Nagoya Univ. (Japan). Dept. of Aeronautical Engineering.

TWO-DIMENSIONAL ANALYSIS OF A FLOW IN AN MPD THRUSTER c20

Hiroyuki Yamada, Takashi Ao, and Toshi Fujiwara *In* Tokyo Univ. Proceedings of the Symposium on Mechanics for Space Flight Mar. 1985 p 67-76 refs (For primary document see N86-23858 14-34)

Avail: NTIS HC A08/MF A01

The present study deals with the numerical simulation of a magneto-hydrodynamic two-dimensional flow based on the one-fluid model, using a second-order-accurate difference scheme. The thruster is composed of a hollow cylindrical anode and a cone-cylinder-shaped cathode. The calculated domain is also enlarged in comparison with a previous analysis. This simulation attempted to reproduce actual phenomena observed in experiments. Author

N86-23865# Nagoya Univ. (Japan). Dept. of Aeronautical Engineering.

A KINETIC THEORY ANALYSIS OF TRANSIENT EVAPORATION PROBLEM

Takeo Soga *In* Tokyo Univ. Proceedings of the Symposium on Mechanics for Space Flight Mar. 1985 p 77-90 refs (For primary document see N86-23858 14-34)

Avail: NTIS HC A08/MF A01

A transient evaporation from a condensed phase surface was studied based upon a kinetic model equation that yields correct Prandtl number Pr. The kinetic equation was reduced to a set of linear differential equations with the aid of half-range Hermite polynomials and the resultant equations were solved by the use of the Laplace transformation. A quasisteady solution for t approximately > 1 was obtained and the results showed that the evaporation rate and the uniform flow behind the evaporation wave or adjacent to the Knudesn layer were little dependent upon Pr but the behavior of the dissipative wave (contact surface) was rightly dependent upon Pr. The evaporation rate obtained showed a good agreement with the one in a previous paper. Author

N86-23866# Tsukuba Univ. (Japan). Institute of Engineering Mechanics.

APPLICATION OF POROUS SOLID NITROGEN TO SPACE BORNE COOLING MISSIONS

Naoki Ichikawa, Masahide Murakami, and Hirotaka Nakai *In* Tokyo Univ. Proceedings of the Symposium on Mechanics for Space Flight Mar. 1985 p 91-104 refs Sponsored in part by Tokyo Univ., Japan (For primary document see N86-23858 14-34)

Avail: NTIS HC A08/MF A01

A basic experiment of the sublimation heat transfer of solid cryogen has been conducted for its potential applications to cryogenic cooling of onboard instruments. The most serious concern is the separation of solid cryogen from a cooling section caused by local rapid sublimation (dry-out). The condition of the dry-out initiation and the heat transfer performance in the dry-out state was especially pursued. The order of the effective thermal conductivity of porous solid nitrogen was found to be almost the same as that of pure one and far smaller than that predicted in the sublimation-filtration-condensation (SFC) process. Application of the solid nitrogen to onboard cooling is also discussed. Author

N86-23867# Tokyo Univ. (Japan).

EFFECT OF NON-CONDENSABLE GAS ON THE VAPOR FLOW IN THERMOSIPHONS

Tsuyoshi Matsumoto and Yasunori Kobayashi *In its* Proceedings of the Symposium on Mechanics for Space Flight Mar. 1985 p 105-112 refs (For primary document see N86-23858 14-34)

Avail: NTIS HC A08/MF A01

A detailed flow field survey was conducted to get a better insight into condensation mechanism of vapor flow onto the cooled plate in the enclosure. A two-dimensional thermosyphon was used as an experimental apparatus and special attention was paid to the effect of non-condensable gas in the thermosiphon. Generally it is understood that the non-condensable gas in the thermosiphon in its steady state operation occupies an upper region of the condensation section, and that there exists an interfacial layer separating vapor flow from non-condensable gas which will move vertically according to the heat input rate applied to the thermosiphon. However the structural properties of this interfacial layer and the boundary layer on the wall of condensation section, such as location of layers, thickness, temperature or density variation across them, have not been thoroughly investigated. A real time laser holographic interferometer was used to visualize a flow field in the thermosiphon. Temperature distribution was measured to evaluate the total heat transfer coefficient in the condensation section. Author

N86-23868# Osaka Univ. (Japan). Dept. of Aeronautical Engineering.

HEAT TRANSFER PERFORMANCES OF A THERMOSYPHON CONTAINED NON-CONDENSIBLE GAS (1)

Kenichi Kaneko and Kanji Negishi *In* Tokyo Univ. Proceedings of the Symposium on Mechanics for Space Flight Mar. 1985 p 113-118 refs (For primary document see N86-23858 14-34)

Avail: NTIS HC A08/MF A01

The heat transfer performances of the thermosiphon contained non-condensible gas with the working fluid were obtained by an experimental study. The relations among the heat transfer rate, the effectively working length of condenser, the temperature difference between the evaporator and the condenser, and the over-all heat transfer coefficient are described. Author

N86-23869# Nippon Inst. of Tech. (Japan).

PERMEABILITY OF A SCREEN WICK

Yoshio Ikeda *In* Tokyo Univ. Proceedings of the Symposium on Mechanics for Space Flight Mar. 1985 p 119-126 (For primary document see N86-23858 14-34)

Avail: NTIS HC A08/MF A01

Permeability of a screen wick for a heat pipe is given by the equation of Blake-Kozeney, but through inspection of this equation, it is expected to be influenced by the magnitude of porosity. Porosity is indistinct because of tightness of the installed wick, influence of the holding spring, etc., and it seems that there is much

difference between actual porosity and porosity calculated by the equation of Marcus. By assuming that the shape of a wire is a series of circular arcs and by considering a model which has arbitrary gaps between layers, the influence of the coefficient of shrinkage, layer gap, the number of layers and so forth on porosity of a screen wick was made evident. Author

N86-23870# Nippon Inst. of Tech. (Japan).
EFFECTIVE THERMAL CONDUCTIVITY OF A SCREEN WICK
Yoshio Ikeda, Makoto Kamata, and Akihiro Shimizu (Tokyo National Coll. of Tech., Japan) *In* Tokyo Univ. Proceedings of the Symposium on Mechanics for Space Flight Mar. 1985 p 127-134 ref (For primary document see N86-23858 14-34)
Avail: NTIS HC A08/MF A01

Effective thermal conductivity of a screen wick filled with working fluid in the case that phase transformation is not considered was calculated by the equation of Maxwell or the equation of Gorring and Churchill. Both of the equations are described as a function of thermal conductivity of working fluid and wick materials, and porosity of the wick. Although, there is much difference for the same porosity, and it is difficult to estimate porosity itself. Here, with consideration of diameter of a wire for a screen wick, mesh number, layer gap and coefficient of shrinkage, the equation to calculate effective thermal conductivity of a screen wick was derived. Author

N86-23871# Tsukuba Univ. (Japan). Institute of Engineering Mechanics.
FLOW OF He 2 THROUGH POROUS-PLUG PHASE SEPARATORS
Hirotaka Nakai, Masahide Murakami, and Naoki Ichikawa *In* Tokyo Univ. Proceedings of the Symposium on Mechanics for Space Flight Mar. 1985 p 135-156 refs Sponsored in part by Tokyo Univ., Japan (For primary document see N86-23858 14-34)
Avail: NTIS HC A08/MF A01

A porous-plug is one of the important components for onboard cooling systems which separates the vapor from the liquid helium (He 2). Flow characteristics through porous-plugs and physical situations of He II flow inside plugs are experimentally investigated by examining the temperature distributions inside plugs. It is clarified that He 2 flows ideally, i.e., London's relation is held, in flows through the most part of a plug and turns into vapor phase near the downstream end of it. The flow of the normal fluid component remains laminar in plugs in any experimental conditions. The liquid-vapor phase boundary is formed just at the downstream end and goes down toward the upstream side as the mass flow rate increases. The thermodynamic states of He 2 are also revealed from these flow characteristics. Author

N86-23872# Tokyo Univ. (Japan).
DEVELOPMENT OF TITANIUM HEAT PIPES FOR USE IN SPACE
Masaru Ishizuka, Tomiya Sasaki, and Yoshiro Miyazaki (Toshiba Corp., Japan) *In its* Proceedings of the Symposium on Mechanics for Space Flight Mar. 1985 p 157-165 refs (For primary document see N86-23858 14-34)
Avail: NTIS HC A08/MF A01

Titanium heat pipe design, manufacture and tests are discussed. The heat pipes developed are a titanium-ammonia heat pipe with axial grooves (FCHP) and a titanium-ammonia-gas loaded variable heat pipe which has a heated reservoir (VCHP). Nitrogen was charged to the VCHP as non-condensible gas. In this heat pipe development program, the manufacturing processes were studied successfully and it was clarified that titanium is very desirable as heat pipe material for use in space. Author

N86-23873# Michigan Univ., Ann Arbor. Dept. of Aerospace Engineering.
THREE-DIMENSIONAL FLOW IN COMPRESSORS AND CHANNELS Final Report, 1 Mar. 1979 - 30 Sep. 1985
T. C. Adamson, Jr. and A. F. Messiter Nov. 1985 23 p
(Contract N00014-79-C-0285)
(AD-A161858) Avail: NTIS HC A02/MF A01 CSCL 20/4

This project was begun in 1979 as a study of three dimensional transonic flows through channels and between compressor blades. In the latter problem, the blades were to be lightly loaded. In 1981, a 3 year study with the broadened goal of studying flow problems in turbomachines was initiated. Specifically, the work was to include a continuation of that in progress on three-dimensional transonic flows through a lightly loaded compressor blade row, supersonic flow over a compression ramp with a turbulent boundary layer, and consideration of transonic flows over heavily loaded blades in a compressor, starting with a two-dimensional cascade and then going to a three-dimensional rotor if the calculations for the cascade was successful. The work in heavily loaded cascades was to build on the experience gained in the lightly loaded case. The work on the compression ramp has application at blade-shroud interfaces in transonic and supersonic flows. Asymptotic methods of analysis have been employed in all the problems to be described, with numerical methods of solution used as needed in some of the inner regions of the flow fields and to illustrate results for example problems. GRA

N86-23874# Naval Research Lab., Washington, D. C.
ENERGY DISSIPATION OF LIQUIDS IN NUTATING SPHERICAL TANKS MEASURED BY A FORCED MOTION-SPIN TABLE Final Report, Jul. 1982 - Jul. 1984
Michael F. Zedd and Franklin T. Dodge 30 Oct. 1985 29 p
(AD-A161864; NRL-8932) Avail: NTIS HC A03/MF A01 CSCL 21/4

A specially constructed drive table is described that can spin and nutate scale-model propellant tanks. Results of typical tests are given in which the liquid resonant frequencies and liquid forces and moments are presented as a function of spin rate, nutation frequency, nutation cone angle, liquid filling level, and liquid viscosity. Also described is an empirical mechanical model composed of a pendulum, a rotor, and dashpots that simulate the liquid resonances (slosh and inertial waves) and the liquid forces and moments. The parameters of the model are determined from the propellant motions. Author (GRA)

N86-23875# Duke Univ., Durham, N. C. Dept. of Mechanical Engineering and Materials Science.
ANALYTICAL PREDICTION OF TURBULENT HEAT TRANSFER PARAMETERS Final Report, 1 Oct. 1980 - 30 Sep. 1984
Adrian Bejan Apr. 1985 92 p
(Contract N00014-79-C-0006; RR)-24)
(AD-A161889; DU-AB-1) Avail: NTIS HC A05/MF A01 CSCL 20/4

The objective of this research is to construct a purely theoretical foundation for the phenomenon of turbulent heat transfer. The research consisted of: (1) identifying the domain covered only the present theory; and (2) identifying the intersection between the present theory and older theories. A complete summary of published articles, books, and theses is appended. GRA

N86-23876# Calspan Field Services, Inc., Arnold AFS, Tenn.
A NONPERTURBING BOUNDARY-LAYER TRANSITION DETECTOR Final Report, Oct. 1983 - Sep. 1985
J E. OHare Nov. 1985 23 p
(AD-A161976; AEDC-TR-85-62) Avail: NTIS HC A02/MF A01 CSCL 20/4

A laser interferometer technique is being applied to the characterization of boundary-layer conditions on models in supersonic and hypersonic wind tunnels. The boundary-layer transition detector (BLTD), based on lateral interferometry, is applicable for determining the turbulence frequency spectrum of boundary layers in compressible flow. The turbulence, in terms of air density fluctuations, is detected by monitoring interferometric fringe phase shifts (in real time) formed by one beam which passes through the boundary layer and a reference beam which is outside the boundary layer. This technique is nonintrusive to the flow field unlike other commonly used methods such as pitot tube probing and hot-wire anemometry. Data which depict boundary-layer transition from laminar to turbulent flow are presented to provide comparisons of the BLTD with other measurement methods.

Spectra from the BLTD reveals the presence of a high-frequency peak during transition which is characteristic of spectra obtained with hot wires. The BLTD is described along with operational requirements and limitations. Author (GRA)

N86-23877# Naval Ocean Systems Center, San Diego, Calif.
COMPARISON OF THE WALL PRESSURE FLUCTUATIONS IN ARTIFICIALLY GENERATED TURBULENT SPOTS, NATURAL TRANSITION AND TURBULENT BOUNDARY LAYERS Final Technical Report
T. S. Mautner Aug. 1985 19 p
(DA Proj. SR0-2301)
(AD-A162114; NOSC/TR-1053) Avail: NTIS HC A02/MF A01 CSCL 20/4

Knowledge of the wall pressure fluctuations beneath transitional and turbulent flows is required in order to understand and reduce aerodynamically and hydrodynamically generated noise. Measurements inside and outside turbulent boundary layers indicate that the wall pressure fluctuations generated by turbulence may well be the dominant mechanism in the generation of near field noise (self-noise) and, if the wall pressure fluctuations are coupled with the vibratory modes of the structure, there will be a significant increase in the sound level radiated into the far field. Wall pressure fluctuations were measured in the plane of symmetry of turbulent spots convecting in a laminar boundary layer having zero, favorable and adverse pressure gradients. The results show that the magnitude of the rms(root mean square) wall pressure and the spectra of the turbulent spot phase of boundary layer transition are strongly influenced by the local mean flow pressure gradient. The data also verifies that boundary layer transition in the presence of an adverse pressure gradient produces rms wall pressure fluctuations which are 1.5 to 2.5 times larger than those found in either a zero or favorable pressure gradient. GRA

N86-23878# Scientific Research Associates, Inc., Glastonbury, Conn.
NUMERICAL SIMULATION OF UNSTEADY THREE-DIMENSIONAL TURBULENT STRUCTURES IN BOUNDARY LAYER FLOWS Final Report, Nov. 1984 - May 1985
Nan S. Lui, Stephen J. Shamroth, and Henry McDonald 15 May 1985 45 p
(Contract F49620-84-C-0107)
(AD-A162130; R85-910011-F; AFOSR-85-1059TR) Avail: NTIS HC A03/MF A01 CSCL 20/4

The capabilities for numerical simulations of the dynamical effects of the underlying structures occurring in turbulent boundary layers have been developed. A mathematically operational model of hairpin vortex, which closely resembles the experimentally observed underlying structure of wall turbulence, has been constructed and the evolution of this incipient hairpin vortex as well as the distortion of a background laminar boundary layer has been successfully simulated. The height of the incipient hairpin vortex is about 1/5 of the local boundary layer thickness. The calculated results not only exhibit most of the prominent features associated with turbulent spots and turbulent boundary layer flows, but also reveal dynamic processes which have been very difficult to observe in experimental studies, notably, the formation and intensification of another counter rotating hairpin vortex immediately upstream of the incipient hairpin vortex. GRA

N86-23879# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A COMPREHENSIVE ANALYSIS ALGORITHM FOR ABLATION, TEMPERATURE FIELDS, AND THERMAL STRESSES OF CARBON-BASED NOSETIP MATERIALS
Zhenzhong Huang 6 Nov. 1985 27 p Transl. into ENGLISH from Yuhang Xuebao (China), no. 3, 1984 p 30-38
(AD-A162359; FTD-ID(RS)T-0701-85) Avail: NTIS HC A03/MF A01 CSCL 07/4

This paper provides the principles for calculations of ablation, conduction, and thermal stresses of flight vehicles in a re-entry environment, as well as a few techniques beyond these principles. In regards to the chemical reactions of carbon-based material ablative surfaces, a selective calculation result is used to simplify the thermochemical ablation calculations. A spaced and non-spaced three-level explicit difference scheme was chosen for use in the calculation of temperature fields. Thermal stresses were calculated using the finite element method within the hypothesis of linear elasticity, based on the incomplete principles of variational potential energy, wherein it is possible to calculate the influences of many different types of displacement boundary conditions. During compilation of these comprehensive analysis procedures, an automated mesh dividing technique was found which has application in selective calculations. GRA

N86-23880# Mitre Corp., McLean, Va.
SUPPRESSION OF CAPILLARY WAVES BY SURFACE-ACTIVE FILMS
David Nelson Nov. 1985 50 p
(Contract F19628-86-C-0001)
(AD-A162881; JSR-85-206) Avail: NTIS HC A03/MF A01 CSCL 20/4

Minute amounts of ampiphillic molecules at an air-water interface can have striking effects on both the damping and generation of capillary waves. The theory of these effects within linearized hydrodynamics is reviewed. The conventional wisdom is that oil calms troubled waters by increasing the rate of capillary wave damping. Although surface-active films can increase the damping rate by factors of two to four, a potentially more important effect is the suppression of capillary wave generation by the wind. In particular, generation by the components of fluctuating Reynold's stresses in the atmosphere parallel to the surface can be reduced by an order of magnitude or more. The theory predicts a more modest suppression of the effect of Reynold's stresses normal to the surface. GRA

N86-23881# Naval Ship Research and Development Center, Bethesda, Md.
CALCULATION OF TWO-DIMENSIONAL NONLINEAR FLUID FLOW RESULTING FROM LARGE-AMPLITUDE FORCED HEAVE MOTION OF A u-SHAPED CYLINDER IN A FREE SURFACE Final Report
John G. Telste Dec. 1985 59 p
(AD-A162969; DTNSRDC-85/086) Avail: NTIS HC A04/MF A01 CSCL 20/4

Progress in developing a tool to compute large amplitude ship motions is reported. In particular, a method to calculate transient two-dimensional potential flow about a body moving in a free surface is described. The flow problem is formulated as an initial-boundary value problem in which the velocity potential along the free surface and the positions of the moving boundaries are sought as solutions of a coupled system of differential equations. An implicit finite-difference method is used to advance the solution of the coupled system of equations in time. The auxiliary problem of computing the velocity potential inside the fluid region is solved by a method which is based on boundary-fitted coordinates and is directly extensible to three-dimensional flows. Results from calculating the potential flow about a body in forced heave motion are presented. The hydrodynamic force on the body has been obtained and compared with the hydrodynamic force predicted from second-order perturbation theory. GRA

N86-23882# Pittsburgh Univ., Pa.
PHYSICS OF PATTERN FORMATION AT LIQUID INTERFACES
1985 9 p
(Contract DE-FG02-84ER-45131)
(DE86-002103; DOE/ER-45131/001) Avail: NTIS HC A02/MF A01

Brief summaries are given of research in the following areas: viscous fingering in Hele-Shaw flow; search for instability on a quenched liquid interface; and binary liquid gels. DOE

N86-23883# Argonne National Lab., Ill.
NONLINEAR STABILITY CONTROL AND SECONDARY BIFURCATION
S. S. Chen, J. A. Jendrzejczyk, W. Edelstein, and E. L. Reiss

1985 6 p Presented at the 3rd Symposium on Energy Engineering Sciences: Thermofluids and Solid Mechanics, University Park, Pa., 8 Oct. 1985 Prepared in cooperation with Northwestern Univ., Evanston, IL.
(Contract W-31-109-eng-38)
(DE86-001813; CONF-8510176-1) Avail: NTIS HC A02/MF A01

Integrated theoretical and experimental studies are performed with the purpose to enhance the understanding of nonlinear stability phenomena involving both fluids and solid structures and their interaction. The objectives are to contribute to the explanation of observed phenomena and, ultimately, to the solution of engineering design problems by means of stability control. This paper presents the results of theoretical and experimental studies of stability control for elastic tubes conveying fluid. DOE

N86-23884# Oak Ridge Gaseous Diffusion Plant, Tenn.
ANALYSIS OF CALIBRATED HOT BOX DATA FOR THREE CONCRETE WALLS
K. W. Childs Sep. 1985 51 p
(Contract DE-AC05-84OT-21400)
(DE86-003157; K/CSD/TM-56) Avail: NTIS HC A04/MF A01

Three walls constructed of concrete with different densities were tested in a calibrated hot box at the Construction Technology Laboratories of the Portland Cement Association. The observed dynamic performance of these walls was not in good agreement with analytical solutions based on the assumption of linear heat conduction through the walls. Several sources of potential errors in the data from the hot box were explored. While some of these errors do appear to be real, they do not fully explain the discrepancy between experimental and analytical results. The experimentally determined values of the specific heats for the three concrete walls were identified as the most likely cause for the discrepancies. This report presents the analysis of the data from the hot box experiments and suggestions for future investigation. DOE

N86-23885# Sandia National Labs., Albuquerque, N. Mex.
RADIATIVE TRANSFER IN A SOLAR ABSORBING PARTICLE LADEN FLOW
W. G. Houf and R. Greif Nov. 1985 24 p Presented at the National Heat Transfer Conference, Denver, Colo., 4 Aug. 1985 Prepared in cooperation with California Univ., Berkeley
(Contract DE-AC04-76DR-00789)
(DE86-002840; SAND-84-8929; CONF-850810-31) Avail: NTIS HC A02/MF A01

A possible receiver configuration is a cavity in which a falling sheet of solid particles is directly irradiated by the concentrated solar flux passing through the aperture. Regardless of the particular geometry, the radiative transfer within the falling particle curtain must be studied in order to determine the net radiative heating rate for the particles. A discrete ordinate radiative transfer model has been developed to predict the radiative coupling within the falling particle curtain. The model determines how much energy is absorbed by the particles, how much is transmitted to the rear wall of the receiver, and determines the effects of particle scattering and thermal emission on the net radiation absorbed by the particles. The model accounts for the directional nature of the radiation field, particle scattering, and the wavelength dependence of the optical properties. The discrete ordinate model has been used to assess the influence of the pertinent radiation transfer parameters in determining the local and overall particle heating rates. The results of this study are discussed as well as the analysis. DOE

N86-23886# Oak Ridge Gaseous Diffusion Plant, Tenn.
FINITE ELEMENT ANALYSIS OF FLOW IN A GAS FILLED ROTATING ANNULUS
M. H. Berger Sep. 1985 31 p refs
(Contract DE-AC05-84OT-21400)
(DE86-004009; K/OA-5968) Avail: NTIS HC A03/MF A01

Linearized multidimensional flow in a gas centrifuge can be described away from the ends by Onsager's pancake equation. However, a rotating annulus results in a slightly different set of boundary conditions than the usual symmetry conditions at the axis of rotation. In this process the problem on an annulus becomes ill-posed and requires some special attention. We treat linear inner and outer rotor temperature distributions and velocity slip. An existence condition for a class of nontrivial, one-dimensional solutions is given. New exact solutions in the infinite bowl approximation have been derived containing terms that are important at finite gap width and nonvanishing velocity slip. The usual one-dimensional axially symmetric solution is obtained as a limit. Our previously reported finite element algorithm has been extended to treat this new class of problems. Effects of gap width, temperature, and slip conditions are illustrated. We report on the compressible, finite length, circular Couette flow for the first time. DOE

N86-23887# Aeritalia S.p.A., Torino (Italy). Gruppo Sistemi Spaziali.
HEAT REJECTION SYSTEM TECHNOLOGY DEMONSTRATION MODEL, PHASE 3 Final Report
L. Costamagna, P. Messidoro, P. Buratti, and F. Capolongo Paris ESA 14 Feb. 1985 99 p refs
(Contract ESTEC-5184/82-NL-AK(SC))
(TD-RP-AI-010; ESA-CR(P)-2130) Avail: NTIS HC A05/MF A01

A fluid loop radiator system to be used for environmental control of advanced spacecraft and/or payloads is discussed. A technology demonstration model (TDM) was built and tested in a vacuum chamber to verify its thermohydraulic performance and the achievement of the requirements previously defined. The model characteristics include Freon coolant at 8 bar loop pressure, automatic control capability, 60 days maximum mission duration, 1 side only radiating panel, 6 Kg weight per sq m, 200 min to 350 max Watt/sq m heat rejection at 40 C fluid inlet temperature, and 910 Kg/hr flow rate in coldest case. The performance test results are presented. Author (ESA)

N86-23888# National Aerospace Lab., Amsterdam (Netherlands). Space Div.
FLUID PHYSICS INSTRUMENTATION STUDY. PART 1: SYSTEM ASPECTS Final Report
J. P. B. Vreeburg, R. H. Huijser, and A. A. M. Delil Paris ESA 18 Jan. 1985 154 p refs 4 Vol.
(Contracts ESA-5188/82-NL-HP(SC); NIVR-1050)
(NLR-TR-85017-L-Pt-1; ESA-CR(P)-2133-Vol-1) Avail: NTIS HC A08/MF A01

Diagnostic methods relevant to the investigation of fluid physics experiments in micro-g were assessed to select instrumentation for a multiuser facility. Many considerations, rooted in power, weight, safety, operation, etc., are shown to have an impact on instrument performance. An optical diagnosis system is defined. The only real limitation imposed on the system is the absence of a parallel illumination beam with a cross-section comparable to the size of the experiment volume. This feature is less important for the classes of problems represented by fluid physics. A diffusely illuminated experiment volume which is a necessary condition for the visualization of edge and gradient distributions was chosen. The system provides the flexibility to install a variety of diagnostic aids. It also offers the possibility to investigate phase objects by interferometry, with a field-of-view 1 sq cm. Since the interesting part of an object can, in most cases, be identified a priori, this restriction on field-of-view is not considered to be a major demerit. Author (ESA)

N86-23889# National Aerospace Lab., Amsterdam (Netherlands). Space Div.
FLUID PHYSICS INSTRUMENTATION STUDY. PART 2: DESIGN REPORT Final Report
R. H. Huijser Paris ESA 28 Feb. 1985 132 p refs 4 Vol.
(Contracts ESA-5188/82-NL-HP(SC); NIVR-1050)
(NLR-TR-85017-L-Pt-2; ESA-CR(P)-2133-Vol-2) Avail: NTIS HC A07/MF A01

A proposed optical diagnostics instrument (PODI) for fluid physics studies in microgravity is described. Components to be used in a breadboard system for PODI are identified and performance predictions for this system are assessed. Photography (and photogrammetry) are used for the definition of positions (P)

within the field of view as related to the determination of locations, shapes, etc., of free liquid surfaces, bubbles, etc. Photography is executed in a diffusely illuminated environment, provided by a white light source and diffuser. Refractive index gradients are studied by observing the deflection of light beams participating in the imaging processes (object grating G1 on reference grating G2 and P on P') in a sharp focused Schlieren system. Grating G1 is diffusely back-illuminated by a white light source. Quantitative local diagnosis is achieved by determining optical path lengths by a system fitted with a Michelson interferometer. The system can be moved over the field of view of the main (wide field) optical system. It employs a laser light source and is provided with suitable relay optics in order to record the interferometric information by means of the (wide field) camera. Author (ESA)

N86-23890# National Aerospace Lab., Amsterdam (Netherlands). Space Div.

FLUID PHYSICS INSTRUMENTATION STUDY. PART 3: BREADBOARD DESCRIPTION AND TEST RESULTS Final Report

D. vandenAssem Paris ESA 28 Feb. 1985 128 p Original contains color illustrations 4 Vol.

(Contracts ESA-5188/82-NL-HP(SC); NIVR-1050)

(NLR-TR-85017-L-Pt-3; ESA-CR(P)-2133-Vol-3) Avail: NTIS HC A07/MF A01

A breadboard of a proposed optical diagnostic instrument for fluid physics research in microgravity was built and tested. The influence of changes at subsystem level were investigated. Vignetting, resolution and distortion of the whole-field system; vignetting and resolution of the interferometer; diagnostic performance of the breadboard using a test experiment set-up (thermal plume); observation tests with a measurement problem, i.e., a block of Schlieren-free optical glass that simulates a class of fluid physics experiments; and instrument operation are described. Further research areas and hardware improvements are identified. Author (ESA)

N86-23891# National Aerospace Lab., Amsterdam (Netherlands). Space Div.

FLUID PHYSICS INSTRUMENTATION STUDY. PART 4: EXECUTIVE SUMMARY, CONCLUSIONS AND RECOMMENDATIONS Final Report

J. P. B. Vreeburg Paris ESA 12 Mar. 1985 23 p refs 4 Vol.

(Contracts ESA-5188/82-NL-HP(SC); NIVR-1050)

(NLR-TR-85017-L-Pt-4; ESA-CR(P)-2133-Vol-4) Avail: NTIS HC A02/MF A01

A fluid physics instrumentation study was conducted to select a fluid physics diagnostic facility for research in microgravity. The study included identification and description of candidate investigative methods; the instrusiveness of measurement technique; and identification and description of representative physical problems for measurements in fluid physics. A breadboard model was built and tested. Author (ESA)

N86-23892# GKSS-Forschungszentrum Geesthacht (West Germany). Inst. fuer Physik.

ON THE FREE CONVECTION PROFILE

M. Claussen and W. V. R. Malkus (MIT, Cambridge, Mass.) 24 Jul. 1985 12 p refs Presented at IAMAP/IAPSO Joint Assembly, Honolulu, Hawaii, 5-16 Aug. 1985

(GKSS-85/E/36; ISSN-0344-9629) Avail: NTIS HC A02/MF A01

The existence of z sup-1 and z sup -1/3 profiles (z being the distance from a boundary) of mean temperature, is examined using results from studies of mechanically similar cylindrical Couette flow. Extension of Malkus' theory leads to a z sup -1/3 boundary law for mean circulation, and to the possibility of a positive gradient on mean circulation in the interior, both features being observed in Couette flow experiments and for mean temperature in data of turbulent convection. It is suggested that these features are consequences of the three-dimensional structure of the mean flow. Author (ESA)

N86-23893# Karlsruhe Univ. (West Germany). Sonderforschungsbereich 210.

THE FLOW ABOUT AND DRAG BEHAVIOR OF WALLS IN TURBULENT BOUNDARY LAYER FLOWS

M. Rau, R. Friedrich, and E. Plate Sep. 1985 127 p refs In GERMAN

(KU-SFB-210/T/8) Avail: NTIS HC A07/MF A01

Wind tunnel investigations of the effect of a two-dimensional, flat plate in a turbulent boundary layer on the flow phenomena and flow forces are reviewed. The flow about a plate is described, and the approaches to calculate the velocity field of single partial domains are outlined. The method to determine drag coefficients is given. Author (ESA)

N86-23894# Karlsruhe Univ. (West Germany). Sonderforschungsbereich 210.

CALCULATION OF FLOW AND POLLUTANT DISPERSION IN MEANDERING CHANNELS

A. O. Demuren and W. Rodi Aug. 1985 50 p refs Sponsored by Deutsche Forschungsgemeinschaft

(KU-SFB-210/T/9) Avail: NTIS HC A03/MF A01

A mathematical model which takes full account of the three-dimensionality of the flow and pollutant concentration fields is presented. It is based on the solution of the momentum equations governing the flow, in the lateral, vertical, and longitudinal directions with a 3D numerical procedure along with the continuity equation. The turbulent stresses appearing in the momentum equations are calculated with a version of k-epsilon turbulence model that accounts for streamline curvature effects on turbulence. The pollutant concentration field is obtained from a solution to its transport equation. The model is tested by application to three different meanders for which velocity and concentration measurements are available, with channel width-to-depth ratios in the range 4 to 20, smooth and rough beds, and various pollutant-discharge locations. Comparisons of the velocity and concentration fields show good agreement. Author (ESA)

N86-23895# Imperial Coll. of Science and Technology, London (England). Computational Fluid Dynamics Unit.

THE NUMERICAL COMPUTATION OF MULTI-PHASE FLOWS

D. Brian Spalding Aug. 1985 26 p refs Presented at Polymodel 8: Industrial Fluid Flow Computation Conference, Cleveland, England, 22 May 1985

(CFD/85/7) Avail: NTIS HC A03/MF A01

The mathematical problem of predicting multiphase flow phenomena by finite volume equations is reviewed. Features shared by multiphase and single phase flows are mentioned. The staggered grid system; terms in the balance equations; and interpolation are outlined. Solving for volume fractions, velocities, and pressures; and convergence are considered. Computer programs for multiphase flow, including PHOENICS, are discussed. Author (ESA)

N86-23896# Imperial Coll. of Science and Technology, London (England). Computational Fluid Dynamics Unit.

APPLICATION OF VARIABLE-BLOCKAGE METHOD TO STEADY FLOWS OVER CURVED BEDS

Liu Jun Sep. 1985 50 p refs

(CFD/85/12) Avail: NTIS HC A03/MF A01

The variable blockage method of simulating flow problems with a free-surface is described. The method is based upon the fact that the surface pressure of water flow in open air is uniform, and the idea that the space occupied by the atmosphere can be numerically made inaccessible to the water by the setting of relevant blockage factors. Advantages of the method are its ability to predict steady free-surface problems and its easy application to nonpotential flows, i.e., to those which are not free of viscous effects. The method was applied to the prediction of steady flows over curved beds. Experimental verification of numerical free-surface form and bed-pressure profile validate the physical realism of the method. Although the method is only evaluated against experimental observation under the shallow flow condition, application to deep flow predictions may be found without introduction of any extra difficulties. The method is very easy to

use when the computer program is equipped with the ability to assign the blockage factors. Author (ESA)

N86-24364# Joint Publications Research Service, Arlington, Va.
EFFICIENCY OF COMPRESSED GAS ENERGY CONVERSION TO LASER RADIATION Abstract Only
V. V. Breyev and V. P. Panchenko *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-004) 7 Feb. 1986 p 8 Transl. into ENGLISH from Teplofizika Vysokikh Temperatur (Moscow, USSR), v. 22, no. 6, Nov. - Dec. 1984 p 1196-1199 (For primary document see N86-24358 14-70)
Avail: NTIS HC A06

N86-24365# Joint Publications Research Service, Arlington, Va.
SHOCKWAVE PROPAGATION IN TRANSVERSE GLOW DISCHARGE PLASMA IN ARGON Abstract Only
I. V. Basargin and G. I. Mishin *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-004) 7 Feb. 1986 p 9 Transl. into ENGLISH from Pisma V Zhurnal Tekhnicheskoy Fiziki (Leningrad, USSR), v. 11, no. 4, 26 Feb. 1985 p 209-214 Previously announced in IAA as A86-13886 (For primary document see N86-24358 14-70)
Avail: NTIS HC A06

N86-24366# Joint Publications Research Service, Arlington, Va.
THERMAL FEATURES OF SUPERSONIC GAS FLOW Abstract Only
G. Ye. Skvortsov and N. Yu. Vasilyev *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-004) 7 Feb. 1986 p 10 Transl. into ENGLISH from Zhurnal Tekhnicheskiy Fiziki (Leningrad, USSR), v. 55, no. 1, Jan. 1985 p 230-232 (For primary document see N86-24358 14-70)
Avail: NTIS HC A06

N86-24367# Joint Publications Research Service, Arlington, Va.
INTERACTION OF GENERATORS WITH EXCITATION AND THE PROBLEM OF TURBULENCE Abstract Only
P. S. Landa and S. M. Perminov *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-004) 7 Feb. 1986 p 12 Transl. into ENGLISH from Izvestiya Vysshikh Uchebnykh Zavedeniy Fizika (Tomak, USSR), v. 27, no. 11, Nov. 1984 p 22-25 Original language document was announced in IAA as A85-22457 (For primary document see N86-24358 14-70)
Avail: NTIS HC A06

N86-24368# Joint Publications Research Service, Arlington, Va.
A GROUP OF OPERATORS OCCURRING IN THE DYNAMICS OF A COMPRESSIBLE STRATIFIED FLUID Abstract Only
S. A. Gabov and K. S. Mamedov *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-004) 7 Feb. 1986 p 14 Transl. into ENGLISH from Doklady Akademii Nauk SSSR (Moscow, USSR), v. 280, no. 1, Jan. 1985 p 23-26 (For primary document see N86-24358 14-70)
Avail: NTIS HC A06

N86-24369# Joint Publications Research Service, Arlington, Va.
COMBUSTION IN TURBULENT BOUNDARY LAYER FOLLOWING SHOCK WAVE Abstract Only
I. N. Zvyeryev, M. I. Ramodanov, and T. V. Ramodanova *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-004) 7 Feb. 1986 p 16-17 Transl. into ENGLISH from Vestnik Moskovoskogo Univ. Seriya 1: Matematika, Mekhanika (Moscow, USSR), no. 2, Mar. - Apr. 1985 p 52-55 (For primary document see N86-24358 14-70)
Avail: NTIS HC A06

N86-24516*# Tennessee Univ. Space Inst., Tullahoma.
LOW DENSITY GAS DYNAMIC WALL BOUNDARY CONDITIONS
Frank G. Collins *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 25 p refs (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 20D

N86-24542*# Memphis State Univ., Tenn. Dept. of Mechanical Engineering.
TURBULENT FLOW FIELD PREDICTIONS IN SHARPLY CURVED TURN AROUND DUCTS
L. Michael Santi *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 38 p refs (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 20D

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources.* For related information see also *06 Aircraft Instrumentation,* and *19 Spacecraft Instrumentation.*

N86-23897 State Univ. of New York, Stony Brook.
PHOTORESIST HOLOGRAPHIC OPTICAL ELEMENTS ON A SPHERICAL SUBSTRATE FOR HIGH RESOLUTION LASER SCANNING APPLICATIONS Ph.D. Thesis
Weiwu Alex Kuo 1985 173 p
Avail: Univ. Microfilms Order No. DA8529798

Theoretical and experimental study of a new type of laser scanner, a holographic scanner recording on a spherical substrate using photoresist technology, is undertaken in this dissertation. A material well-suited for recording holographic scanners and mass producing holograms is photoresist, because it possesses high resolution, high efficiency, tough physical properties and replication capability. Little information is available in the literature concerning the experimental technique, which has to be carefully controlled for optimum results. The work reported here establishes the detailed characteristics of the Shipley AZ-1450J photoresist for the recording of holographic optical elements. The modulation depth has been modeled and experimentally studied as a function of the various relevant parameters. As currently utilized in a variety of tasks in sampling, scanning, digitizing or reconstructing information, classical laser scanners suffer from several disadvantages.
Dissert. Abstr.

N86-23898 Rochester Univ., N. Y.
PARTICLE DISPLACEMENT AND VELOCITY MEASUREMENT USING HOLOGRAPHY Ph.D. Thesis
Philip Herbert Malyak 1985 233 p
Avail: Univ. Microfilms Order No. DA8528552

A method of measuring particle displacements and velocities in the transform plane of a double-exposure hologram is examined both theoretically and experimentally. The analysis begins with a study of the transform patterns obtained from single-exposure holograms. The Fourier transform patterns of double-exposure holograms are then examined, and it is shown that each pair of particles images related to translation contributes a set of osine fringes to the total diffraction pattern. The frequency and orientation of the fringes are related to the magnitude and direction, respectively, of a given particle's displacement or velocity. The transform patterns corresponding to 1- and 2-dimensional distributions of displacement are examined in detail. For the 1-dimensional case, a theoretical analysis indicates that the probability density function characterizes the distribution of displacements that may be determined by properly processing intensity data measured in the transform plane of a doubly exposed hologram.
Dissert. Abstr.

N86-23899*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
APPARATUS AND FURNACE FOR CONTAINERLESS PROCESSING OF HIGH TEMPERATURE MATERIALS IN SPACE Patent Application

Michael B. Robinson and Lewis L. Lacy, inventors (to NASA) Filed 5 Dec. 1985 13 p
(NASA-Case-MFS-28087-1; NAS 1.71:MFS-28087-1; US-Patent-Appl-SN-805010) Avail: NTIS HC A02/MF A01 CSCL 14B

The electron bombardment furnace consists of two confinement grid sections which may be moved and separated from each other. Inside the bombardment furnace, a tungsten element is enclosed. The material specimen is located within the tungsten element and grounded by means of grounded support wires connected to the respective sections of the furnace. The material specimen is supported on the ground wires and heated by electron bombardment until melt occurs. The furnace sections are separated in opposite directions causing the ground wires to pull from the surfaces of the specimen, leaving the specimen freely suspended in the process chamber without the action of external forces. The specimen remains in its melt condition in the processing chamber where it can be undercooled without external forces acting on the specimen, which would cause dynamic nucleation. NASA

N86-23900# Naval Health Research Center, San Diego, Calif.
CHRONIC SWINE INSTRUMENTATION TECHNIQUES UTILIZING THE GOR-REX PERITONEAL CATHETER Interim Report
C. C. Gray, F. C. White, R. P. Crisman, J. Wisniewski, and D. McKirnan May 1985 20 p
(AD-A162173; NAVHLTHRSCHC-85-16) Avail: NTIS HC A02/MF A01 CSCL 06/16

The GORE-TEX peritoneal catheter interface is an effective skin interface device for many types of instrumentation in the swine. When properly utilized, the interface allows the development of a stable and effective biological seal which will reduce or eliminate sinus tract formation and resultant systemic infection. The interface is suitable for running any wire or catheter (up to about 2.5mm diameter) through the integument of the animal, thus increasing the possibilities for chronic instrumentation while maintaining a healthy animal. The lack of evidence of any growth phenomenon acting to extrude the interface segment, similar to that observed using other synthetic materials, and the superior biological seal which the interface develops, may allow many chronic studies which were previously not feasible. Using special catheter adapter stubs and an intermittent infusion plug, a sterile, sealed catheter system has decreased the possibilities for introducing pathogens while allowing ready access to the blood stream. Detailed descriptions of surgical implantation techniques and catheter set up and maintenance techniques are included. GRA

N86-23901# Department of the Navy, Washington, D. C.
AN APPARATUS FOR AND A METHOD OF MEASURING MAGNETIC EFFECTS DUE TO EDDY CURRENTS Patent Application
Paul B. Tarr, inventor (to Navy) Filed 24 Jun. 1985 21 p
(AD-D012061; US-Patent-Appl-SN-748376) Avail: NTIS HC A02/MF A01 CSCL 14/2

An eddy current effects measurement apparatus employs, inter alia, a reference sensor located so that it measures an applied field and any environmental fields but does not measure eddy current effects. Then an estimate(s) of the applied field at the locus of a plurality of measurement sensors is constructed and stored. Next, a conductive object or material to be measured is placed in the applied field in the vicinity of the plurality of measurement sensors away from the reference sensor and measurements are made of the applied field, any environmental fields and any fields due to the effects of eddy currents induced into the conductive object or material. Finally, the aforementioned stored estimate(s) are used to compensate the applied field at the locus of the plurality of measurement sensors so that the eddy current effects due to the placement of the conductive object or material can be observed on a keyboard/display or printed via a printer/plotter. GRA

N86-23902# Department of the Navy, Washington, D. C.
COMBUSTOR FIBERSCOPE Patent Application
W. W. Morey and E. Snitzer, inventors (to Navy) Filed 6 Sep. 1985 14 p
(AD-D012063; US-Patent-Appl-SN-773276) Avail: NTIS HC A02/MF A01 CSCL 14/2

A fiberscope of the viewing of the interior of an operating engine combustor is provided with a fused coherent fiber bundle as an image conduit to transmit the image of said interior through the wall of the combustor. Illumination may be provided through the use of a second optical fiber or bundle and a coherent light source aligned with the image conduit. GRA

N86-23903# Department of the Navy, Washington, D. C.
THERMALLY BUFFERED SODIUM-NEON LASER TARGET FOR COHERENT X-RAY PRODUCTION Patent Application
Frederick Cochran, Jack Davis, and John Apruzese, inventors (to Navy) Filed 2 Dec. 1985 22 p
(AD-D012070; US-Patent-Appl-SN-795795) Avail: NTIS HC A02/MF A01 CSCL 14/2

Objects of this patent application include: generating coherent X-rays; using Na and Ne to produce X-rays; and providing a thermal buffer between Na and Ne to prevent the Na from heating and overionizing the Ne and precluding the generation of coherent X-rays. These and other objects are accomplished with an apparatus for generating coherent X-rays comprising: an Na layer; a Ne layer; a thermal transparent buffer layer located between and in contact with the Na layer and the Ne layer; a lower power laser to heat the Ne layer; and a higher power laser to heat the Na layer. GRA

N86-23904# Lawrence Livermore National Lab., Calif.
FIBER OPTICS TEMPERATURE AND PRESSURE PROBE Progress Report, 1984 - 1985
G. Haugen and T. Hirschfeld Oct. 1985 74 p
(Contract W-7405-eng-48)
(DE86-002379; UCID-20563) Avail: NTIS HC A04/MF A01

The feasibility of remote sensing of pressure in a hostile or inaccessible environment using a single fiber and a spectroscopic sensor is described. This type of system is immune to electromagnetic noise, low in cost, rugged, and has a sensing volume of less than 4 x 10 to the -6 power/cm cu. In particular, a ruby crystal was evaluated as an optical fiber-spectroscopic sensor for pressure, because ruby has been used as a hydrostatic pressure sensor in gasketted diamond anvil cells. It is anticipated that remote pressure measurements will be non-isothermal in contrast to the isothermal diamond anvil pressure measurements. Since the coefficients of linear compression are isotropic and the thermal coefficients are anisotropic, this suggests that a ruby sensor could measure both temperature and pressure. This article examines the practicality of using a ruby sensor as a non-isothermal pressure sensor. The design criteria for an optical-fiber/ruby-sensor fluorometer was critically characterized. DOE

N86-23905# Los Alamos National Lab., N. Mex.
INSTRUMENTATION TECHNIQUES FOR MONITORING SHOCK AND DETONATION WAVES
R. D. Dick and R. L. Parrish 1985 9 p refs Presented at the Society of Experimental Mechanics Fall Conference, Grenelefe, Fla., 17 Nov. 1985 Prepared in cooperation with Sandia National Labs., Albuquerque, N. Mex.
(Contract W-7405-eng-36)
(DE86-002388; LA-UR-85-3521; CONF-8511106-2) Avail: NTIS HC A02/MF A01

CORRTEX (Continuous Reflectometry for Radius Versus Time Experiments), SLIFER (Shorted Location Indication by Frequency of Electrical Resonance), and pin probes were used to monitor several conditions of blasting such as the detonation velocity of the explosive, the functioning of the stemming column confining the explosive, and rock mass motion. CORRTEX is a passive device that employs time-domain reflectometry to interrogate the two-way transit time of a coaxial cable. SLIFER is an active device that monitors the changing frequency resulting from a change in length of a coaxial cable forming an element of an oscillator circuit. Pin probes in this application consist of RG-174 coaxial cables,

each with an open circuit, placed at several known locations within the material. Each cable is connected to a pulse-forming network and a voltage source. When the cables are shorted by the advancing wave, time-distance data are produced from which a velocity can be computed. Each technique, installation of the gauge, examples of the signals, and interpretation of the records are described. DOE

N86-23906# Los Alamos National Lab., N. Mex.
HIGH RANGE GAMMA RADIATION METER
W. Baird, G. O. Bjarke, and Y. Eisen 1985 8 p Presented at the IEEE Nuclear Science Symposium, San Francisco, Calif., 23 Oct. 1985
(Contract W-7405-eng-36)
(DE86-002413; LA-UR-85-3663; CONF-851009-2) Avail: NTIS HC A02/MF A01

A low power meter has been constructed and tested to measure gamma fields from .1 R/hr to 1500 R/hr over the energy range of 60 keV to 1.2 MeV. The portable, battery-powered meter consists of a local display unit and remote probe. The display unit indicates gamma intensities via a 4-1/2 digit liquid crystal display (LCD) and a 50-segment bargraph LCD. DOE

N86-23907# Los Alamos National Lab., N. Mex.
SOLID STATE DIRECTIONAL GAMMA DETECTOR
W. Baird, W. P. Unruh, G. O. Bjarke, and P. K. Beauchamp 1985 11 p refs Presented at the IEEE Nuclear Science Symposium, San Francisco, Calif., 23 Oct. 1985
(Contract W-7405-eng-36)
(DE86-002414; LA-UR-85-3643; CONF-851009-4) Avail: NTIS HC A02/MF A01

A solid-state gamma-ray detector has been developed which exhibits directionality. Four PIN diode detectors are backed with Pb and arranged in a square array which exhibits an angular response to gamma rays. The high-Z material provides directionality and also enhances the sensitivity of the detectors to high-energy gammas by means of the X-ray fluorescence accompanying photon interactions in the backing. The array responses are used to identify the quadrant containing the source and obtain the radiation level. Ratios of the counting rates in opposite pairs of detectors are used to determine the angular position of the source within the quadrant. DOE

N86-23908# Du Pont de Nemours (E. I.) and Co., Aiken, S.C.
ONLINE FIBER-OPTIC PHOTOMETER
D. R. VanHare, W. S. Prather, D. A. Boyce, and W. A. Spencer 1985 17 p Presented at the Du Pont Process Analytical Symposium, Wilmington, Del., 16 Oct. 1985
(Contract DE-AC09-76SR-00001)
(DE86-003142; DP-MS-85-127; CONF-8510178-2) Avail: NTIS HC A02/MF A01

The development and implementation of a fiber-optic photometer for process control at the Savannah River Plant (SRP) will be discussed. The instrument is a modified Du Pont 400 photometric analyzer which incorporates quartz fiber-optic cables, a high-intensity tungsten-halogen lamp source, and a sight glass with sealed optics. Six of these photometers have been installed at SRP to monitor the elution of neptunium or plutonium from anion exchange columns. The fiber optics allow the instrument to be located 50 feet from the sight glass, which is in a highly radioactive area. This ensures easy access to the instrument and minimizes radiation exposure to personnel. The modifications to the analyzer and its application to process control will be presented. DOE

N86-23909# Los Alamos National Lab., N. Mex.
RADIATION MONITOR FOR SURVEILLANCE OF MOVING VEHICLES
R. F. Dvorak Sep. 1985 18 p
(Contract W-7405-eng-36)
(DE86-003287; LA-10446-MS) Avail: NTIS HC A02/MF A01

A radiation monitor has been developed that will scan each vehicle leaving the Clinton P. Anderson Los Alamos Meson Physics Facility site. If an increase in radiation level is sensed, an alarm light and a Klaxon horn are activated, inviting the driver to return to the Health Physics office for check. A photograph showing the vehicle license number is also taken. A radiation source that doubles the detector count rate when stationary will cause an alarm at vehicle speeds up to about 24 km/h (15 mph). The technique used to prevent false alarms because of radiations from nearby buildings or from plumes of low-level radioactive gas is described. DOE

N86-23910# Mound Lab., Miamisburg, Ohio.
DESIGN, DEVELOPMENT AND APPLICATION OF A THERMAL ANALYSIS MASS SPECTROMETER
R. O. Yelton, T. L. Shell, and D. M. Colman 30 Sep. 1985 6 p
(Contract DE-AC04-76DP-00053)
(DE86-003746; MLM-3295) Avail: NTIS HC A02/MF A01

To supplement the information that can be obtained with differential scanning calorimetry (DSC) and thermogravimetric analysis (TGA), a thermal analysis mass spectrometer system has been developed. In this system, instruments for DSC and TGA are interfaced to a computer-controlled quadrupole mass spectrometer. Configured from traditional equipment modified for this use plus an IBM personal computer, the thermal analysis mass spectrometer provides a new capability in that gaseous by-products can be identified while the parent materials, such as plastics and energetic materials, are undergoing thermal analysis. DOE

N86-23911# Farran Research Associates, (Ireland).
SUB-MILLIMETER (FAR IR) HETERODYNE SPECTROMETER (DEMONSTRATION MODEL) Final Report
W. M. Kelly, S. U. Lidholm, G. T. Wrixon, J. Coughlan, E. Redmond, T. Murphy, and B. OSullivan Paris ESA Jun. 1985 50 p
(Contract ESTEC-5499/83-NL-PP)
(FTL-068519; ESA-CR(P)-2119) Avail: NTIS HC A03/MF A01

Submillimeter heterodyne receiver measurement results of the lower frequency band, 330 to 378 GHz, where the lowest receiver noise temperature (TMXR) = 6000K and conversion loss (LMXR) = 11dB are given. Measurement results of the higher frequency band, 400 to 462 GHz, are given where TMXR = 19400K (DSB) at fLO = 462 GHz and DSB mixer noise temperature = 13200K, and LMXR = 17.1dB. The methods used in measuring the receiver noise temperature, mixer conversion losses, and mixer noise temperatures are outlined. Phase lock loop performance is discussed. Receiver measurements indicate that further alignement of the receiver is required, which is non trivial due to the complexity of the optics. This could reduce the coupling loss by 3dB, resulting in a DSB receiver noise temperature of 4500K at 365 GHz (TMXR = 3000K and LMXR = 8dB) and a noise temperature of 9700K at 465 GHz (TMXR = 6600 and LMXR = 14dB). Author (ESA)

N86-23912# Max-Planck-Inst. fuer Quantenoptik, Munich (West Germany).
PLANS FOR A LARGE GRAVITATIONAL WAVE ANTENNA IN GERMANY
Walter Winkler, Karl Maischberger, Albrecht Ruediger, Roland Schilling, Lise Schnupp, and David Hoemaker Aug. 1985 14 p refs Presented at 4th Marcel Grossmann Meeting, Rome, Italy, Jun. 1985
(MPQ-101) Avail: NTIS HC A02/MF A01

A gravitational wave antenna design is outlined. Arms 3 km in length are proposed, as a tradeoff between cost and the influence of thermal mirror motion. Tunnels, completely or partly below the surface, are to house the vacuum tubes. Besides the standard single 90 deg interferometer, a redundant triangular configuration consisting of three 60 deg interferometers is considered. The size of the mirrors depends on the choice between delay lines and Fabry-Perot cavities. A set of relatively large mirrors is to be manufactured and tested. Components for light modulation and guiding need research. Light power enhancing techniques (injection locking, recycling) are to be investigated. Improved frequency stabilization is to be developed, and phase modulation of the laser light (to reduce noise due to scattered light) is to be tried.
Author (ESA)

N86-23913# Nationaal Inst. voor Kernfysica en Hoge Energiefysica, Amsterdam (Netherlands). Sectie-K.
TIMING APPARATUS [TIMING APPARATUUR]
P. Timmer 2 Nov. 1985 17 p refs In DUTCH
(LINO-124) Avail: NTIS HC A02/MF A01

The apparatus required for bundle-synchronous timing is described. Bundle-synchronous timing signals are used along accelerators and in experimental stations. The apparatus consists of a trigger modulator, a trigger detector, a delayed pulse generator, and a pulse output module. The excitation and detection of bundle-synchronous triggers, and the pulse output module are described. The trigger network, including modulator and detector, is explained. Author (ESA)

N86-23914# Agricultural Research Service, Beltsville, Md.
EXPERIMENTAL DELAYED-LIGHT-EMISSION METER FOR HORTICULTURAL CROPS
W. R. Forbus, G. A. Hardigree, and J. H. Adams Sep. 1985 13 p
(PB86-110079; ARS-41) Avail: NTIS HC A02/MF A01 CSCL 02D

Equipment for measuring the delayed light emission (DLE) from horticultural crops was developed for use in a long-range study to determine the feasibility of sorting different fruits and vegetables according to maturity by measuring the light emitted from them several seconds after illumination by a controlled light source. Preliminary tests with tomatoes showed that the magnitude of detector response to DLE decreased during apparent ripening as indicated by an increase in red color. GRA

N86-23764# Joint Publications Research Service, Arlington, Va.
HIGH-SPEED HOLOGRAM CAMERA DEVELOPED Abstract Only
In its China Report: Science and Technology (JPRS-CST-86-005) 11 Feb. 1986 p 120 Transl. into ENGLISH from Xinhua (Beijing, China), 12 Dec. 1985 (For primary document see N86-23762 14-31)
Avail: NTIS HC A07/MF A01

N86-23765# Joint Publications Research Service, Arlington, Va.
STUDY ON NORMALIZATION OF INSTRUMENT FOR MEASURING MODULATED TRANSFER FUNCTION IN INFRARED RANGE AT ZERO SPATIAL FREQUENCY Abstract Only
Zhuoxiang Feng and Zhongben Liu *In its* China Report: Science and Technology (JPRS-CST-86-005) 11 Feb. 1986 p 131-132 Transl. into ENGLISH from Hongwai Yanjiu (Shanghai, China), vol. 4, no. 5, Oct. 1985 p 335-340 (For primary document see N86-23762 14-31)
Avail: NTIS HC A07/MF A01

N86-23775# Joint Publications Research Service, Arlington, Va.
TRENDS IN TACTILE BIOSENSORS, SMELL-SENSITIVE BIOSENSORS
Kohei Higuchi, Yoshie Kawana, and Jun Kimura *In its* Japan Report: Science and Technology (JPRS-JST-86-007) 25 Mar. 1986 p 6-17 Transl. into ENGLISH from Bio Industry (Tokyo, Japan), Dec. 1985 p 38-45 (For primary document see N86-23773 14-31)
Avail: NTIS HC A04/MF A01

N86-23836# National Bureau of Standards, Gaithersburg, Md. Electronic Instrumentation and Metrology Electrosystems Div.
CHARACTERIZATION OF WAVEFORM RECORDERS
Donald R. Flach *In its* Digital Methods in Waveform Metrology Oct. 1985 p 31-53 refs (For primary document see N86-23833 14-33)
Avail: NTIS HC A09/MF A01 CSCL 14C

N86-24518*# Oregon Univ., Eugene. Inst. of Theoretiical Science.
CALCULATIONS ON THE PRODUCTION AND USE OF SUPERFINE HOLOGRAPHIC X-RAY GRATINGS FOR ASTROPHYSICAL OBSERVATIONS
Paul L. Csonka *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 14 p refs (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04

N86-24545*# California Univ., San Diego. Center for Astrophysics and Space Science.
AUTOMATED CALIBRATION OF A FLIGHT PARTICLE SPECTROMETER
Roy B. Torbert *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 18 p (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 14B

36 LASERS AND MASERS

Includes parametric amplifiers.

N86-23915 California Univ., Santa Barbara.
CLASSICAL AND QUANTUM APPROACHES TO THE FREE ELECTRON LASER Ph.D. Thesis
Piermario Bosco 1985 133 p
Avail: Univ. Microfilms Order No. DA8528603

The classical spontaneous emission from relativistic electrons injected into conventional and tapered free electron lasers undulators is investigated both theoretically, by solving the relative equations of motion, and numerically, using the obtained results. The evolution of the optical field in the undulator's cavity is analyzed both quantum mechanically, by solving perturbatively the Dirac equation in the laboratory frame and the Schrodinger equation in a realtivistic moving frame. The classical aspect of the results obtained is emphasized. The evolution of the fields is then studied classically for electron beams with a realistic energy and angular spread. The relative gain formulas are then derived and compared to the formula found both classically and quantum-mechanically. Dissert. Abstr.

N86-23916 Deutsche Geodaetische Kommission, Munich (West Germany).
SYSTEMS ANALYSIS OF LASER RANGEFINDING Ph.D. Thesis - Tech. Univ. Munich, West Germany
Dieter Egger Bayerischen Akademie der Wissenschaften 1985 163 p refs In GERMAN; ENGLISH summary
(Ser-C-311; ISBN-3-7696-9361-2; ISSN-0065-5325) Copyright. Avail: Issuing Activity

Rangefinding by measuring round-trip travel times of laser pulses was studied using a systems analysis approach. A detailed model of the measurement process was developed and implemented on a mainframe computer. Ranging to LAGEOS, STARLETTE and GEOS-3, to the Moon, and to a terrestrial target were simulated. Simulation of laser ranging provides estimates of corrections to travel times due to the atmosphere, reflector array, trigger etc., as well as their statistical confidence. Arbitrary variants of components and variations of parameter settings of the measurement system (e.g., laser, telescope, trigger, satellite) can be examined, in particular those which are not yet technically realized. Author (ESA)

N86-23917# Iowa Univ., Iowa City.
A LASER TRAP FOR NEUTRAL ATOMS Annual Report, 15 Nov. 1984 - 14 Nov. 1985
William C. Stwalley 12 Nov. 1985 18 p
(Contract N00014-83-K-0646)
(AD-A161834; IATRAP-85-1) Avail: NTIS HC A02/MF A01 CSCL 20/7

A laser trap for neutral atoms, initially potassium (K) is constructed. At low densities, such a trap could be used to address a number of fundamental questions, e.g., the interaction of an individual atom with an electromagnetic field, collision dynamics and recombination. The feasibility and limitations of a purely laser trap concept, a corner cube trap, are studied for trapping neutral K atoms. The confinement of the atoms in the two dimensions perpendicular to the laser will be provided in the cavity of a high

power alexandrite laser operating in the doughnut mode tuned slightly to the blue side of the 4s 2S1/2 to 2P3 resonance line of the K atom. This trap concept employs not laser cooling, but rather counterstreaming 4He atoms which are cooled to about 1.5 K, to drastically cool the K atoms to thermal energies well below the trap depth (expected to be about 10 K). K atoms can be lost to the trap if they are multiphoton ionized, if they are heated by absorption and emission of many photons (recoil or diffusional heating), if they simply have much higher energy than the vast majority of other atoms at 1.5 K, or if they recombine with He atoms to form KHe (or KHe2, etc.). GRA

N86-23918# Dartmouth Coll., Hanover, N.H.
A RAMAN FEL (FREE ELECTRON LASER) AT 2mm WAVELENGTH. DESIGN OF AN EFFICIENCY-ENHANCED RAMAN FEL OSCILLATOR Annual Technical Summary and Status Report, Oct. 1984 - Oct. 1985
J. Masud, F. G. Yee, T. C. Marshall, and S. P. Schlesinger Oct. 1985 36 p
(Contract N00014-79-C-0760)
(AD-A161955) Avail: NTIS HC A03/MF A01 CSCL 20/5

The nonlinear physics of the free electron laser (FEL) involves waves set up in a nearly cold electron beam when it passes through the undulator. In addition to the pump field and the growing scattered EM wave moving parallel to the electrons, there is a disturbance in the beam space charge caused by the ponderomotive force. In this paper we discuss initial experimentation using a simple Raman oscillator and amplifier. The purpose of the oscillator is to define initially the regions of substantial gain by observing the emission wavelength. Following this, the gain is observed in and amplifier configuration, using a CO sub 2 laser pumping an NH sub 3 gaseous laser at 140 GHz (2.14mm). GRA

N86-23919# Maryland Univ., College Park. Dept. of Electrical Engineering.
STUDY OF COLD-CATHODE AND RF-EXCITATION FOR LOW POWER CO2 WAVEGUIDE LASERS Final Report
U. Hochuli Oct. 1985 35 p
(Contract N00014-79-C-0312; RR0-1107)
(AD-A162037) Avail: NTIS HC A03/MF A01 CSCL 20/5

Initial results indicate that transversely RF excited 2W CW CO2 waveguide lasers can be built to last in excess of 10000 hours. This result has been achieved with either internal electrodes or capacitive wall coupling and with either CO-or N2-bearing gas mixtures. On-off switching seems to be quite well tolerated. RF conductance and starting voltage measurements for six different gas mixtures and four pressure parameters are given. GRA

N86-23920# LTV Aerospace and Defense Co., Dallas, Tex. Missiles and Advanced Programs Div.
PHOTON AVALANCHE LASER IMPROVEMENT PROGRAM Final Report, Nov. 1983 - Nov. 1984
M. E. Koch Dec. 1984 73 p
(Contract N00014-84-C-2019; ARPA Order 4320)
(AD-A162100; Rept-3-32300/5CR-9; R-93000/3P-4) Avail: NTIS HC A04/MF A01 CSCL 20/5

The main thrust of this program was to increase the output power and efficiency of a photon avalanche laser demonstrated in an earlier and related program. However, material problems plagued the effort from the outset. Identification and solution of these problems has led to an enormous increase in production yield of Pr doped LaCl3 laser crystals as well as the discovery of a contaminate which needs to be eliminated in future work. Overall, an increase in laser power output has not achieved, but new insights may lead to large payoffs in the near future. GRA

N86-23921# Rockwell International Science Center, Thousand Oaks, Calif.
LASER EVAPORATION STUDIES Annual Report, 1 Sep. 1984 - 30 Jun. 1984
H. Sankur Jul. 1985 41 p
(Contract F49620-84-C-0091)
(AD-A162346; SC5411.2AR; AFOSR-85-0992TR; AR-1) Avail: NTIS HC A03/MF A01 CSCL 20/6

The use of a pulsed laser to evaporate dielectric materials for optical thin film deposition was investigated. Studies were performed to analyze the species present in the evaporant plume generated by a 1.5 Joule TEA-CO2 laser. the materials investigated were Al2O3, SiO2, ZnO, PbF2, TiO2, and HfO2. Experiments were performed in a cryopumped system with a base pressure of 10 to the 8th power torr. The evaporant plume was characterized using luminescence spectroscopy, mass spectroscopy, and ion current analysis. Luminescence studies indicated the existence of excited state neutrals and singly, doubly and triply ionized species. Plasma electron temperatures of 6500 K were deduced from a study of neutrals in the plumes of SiO2 and Al2O3. Molecular species were found in significant concentrations only for higher (.001 torr) residual gas pressures. Ion current analysis demonstrated the existence of several species for each compound, each with different velocities. Velocities of 15 million cm/sec indicated very high kinetic energies for the ionized species. In the following phase of the program, the effects of excited state and energetic species on thin film growth will be investigated. GRA

N86-23922# Stanford Univ., Calif. Lab. of Physics.
DIODE PUMPED FIBER LASER Interim Report, 1 Sep. 1983 - 2 Jul. 1984
Cel Gaeta and Michel Digonnet Dec. 1984 101 p
(Contract F33615-82-C-1749)
(AD-A163106; GL-3756; AFWAL-TR-84-1159) Avail: NTIS HC A06/MF A01 CSCL 20/5

Work conducted in the area of single crystal fiber optical devices is described. Miniature Nd:YAG 1.32 micron lasers were fabricated using both free space (unguided) and single crystal fiber configurations. Bulk lasers with thresholds as low as 19 mw and near optimum slope efficiencies of 36% were demonstrated. Several guided fiber lasers were also successfully brought to oscillation. The best device has a threshold of 12 mw, a slope efficiency of 22%, and a maximum recorded output power at 1.32 micrometers of 22 mw. Fiber scattering properties inferred from these measurements indicate that the crystal fiber used in this work exhibit a much higher quality than the fibers used in earlier phases of this work as a result of improved growth conditions. A theoretical investigation of 1.32 micrometers optically-pumped lasers was also developed for interpretation of experimental data. A feasibility study of Q-switched fiber lasers operating near lambda = 1.06 micrometers was also conducted. Theoretical expressions for the laser output peak power, pulse width and energy were cast in a simple form by implementing the formalism of normalized mode overlap coefficient introduced earlier in this work. Peak powers on the order of 100 to 500 watts and pulse widths of a few nanoseconds are anticipated for fiber lasers were also reviewed and compared to provide a recommended guideline for future laser work. GRA

N86-23923# Los Alamos National Lab., N. Mex.
COMPARISON OF THE RESULTS OF THEORETICAL CALCULATIONS WITH EXPERIMENTAL MEASUREMENTS FROM THE LOS ALAMOS FREE-ELECTRON LASER OSCILLATOR EXPERIMENT
J. C. Goldstein, B. E. Newnam, R. W. Warren, and R. L. Sheffield 1985 34 p Presented at the 7th International Free-electron Laser Conference, Tahoe City, Calif., 8 Sep. 1985
(Contract W-7405-eng-36)
(DE86-002382; LA-UR-85-3556; CONF-850956-4) Avail: NTIS HC A03/MF A01

A comparison between some of the measurements made with a uniform wiggler during the Los Alamos free-electron laser oscillator experiment and the results of one-dimensional pulse propagation calculations using the mathematical model of Colson and Ride will be presented. Small-signal gain data will be discussed. Calculated output power vs. optical resonator length will be compared with data. Time-integrated optical spectral data, which show clear evidence for Raman sidebands, will be compared with calculated spectra as a function of resonator length. The calculated electron energy distribution function, using the measured electron-

beam micropulse shape, and the associated extraction efficiency will be compared with measurements. DOE

N86-23924# Los Alamos National Lab., N. Mex.
STATUS OF THE LOS ALAMOS FREE-ELECTRON LASER
J. M. Watson 1985 9 p Presented at the 7th International Free-electron Laser Conference, Tahoe City, Calif., 8 Sep. 1985
(Contract W-7405-eng-36)
(DE86-003656; LA-UR-85-4071; CONF-850956-15) Avail: NTIS HC A02/MF A01

Since the initial oscillator experiments were completed last year, the Los Alamos FEL has undergone some major modifications and additions in preparation for the next set of experiments. The laser performance is projected to be substantially enhanced, the rf energy-recovery technique will be demonstrated, and FEL physics measurements will be expanded. The accelerator is now being tuned with very promising performance. The above experiments will be completed during the next year. DOE

N86-23925# Los Alamos National Lab., N. Mex.
KINETICS OF PROPOSED GAMMA-RAY LASERS
G. C. Baldwin 1985 14 p Presented at the 7th International Workshop on Laser Interaction and Related Plasma Phenomena, Monterey, Calif., 28 Oct. 1985
(Contract W-7405-eng-36)
(DE86-003682; LA-UR-85-3957; CONF-851053-6) Avail: NTIS HC A02/MF A01

Gamma-ray lasers, although proposed for many years, remain undeveloped because pumping can destroy conditions essential for gain. We review many of the solutions (viz, narrowed-line, explosive neutron pump, two-stage pump, two-step pump) proposed so far, with emphasis on kinetics. The most promising approach requires fast interlevel transfer from a separated isomer to initiate a superradiant Borrmann mode in a solid host. However, suitable nuclear transitions and nondestructive transfer mechanisms have yet to be identified. DOE

N86-23926# California Univ., Berkeley. Lawrence Berkeley Lab.
SOME CONCEPTS TO IMPROVE THE PERFORMANCE OF dc ELECTROMAGNETIC WIGGLERS
K. Halbach Oct. 1985 22 p Presented at the 7th International Free-Electron Laser Conference, Tahoe City, Calif., 8 Sep. 1985
(Contract DE-AC03-76SF-00098)
(DE86-002956; LBL-20502; CONF-850956-17) Avail: NTIS HC A02/MF A01

Electromagnetic wigglers have serious performance limitations when the period needs to be small. After a discussion of the nature of these limitations, some concepts will be described that lead to dc electromagnetic wigglers with improved performance. This is accomplished by a better choice of the geometrical arrangement of the soft iron and the coils, and by judicious use of permanent magnet material. DOE

N86-23927# North Carolina Univ., Asheville. Dept. of Physics.
DITHER-FREE STABILIZATION OF CO2 LASERS FOR FAR INFRARED PUMPING: A PHOTOACOUSTIC APPROACH
C. A. Bennett, Jr. and D. P. Hutchinson 1985 3 p Presented at the International Conference on Infrared and Millimeter Waves, Lake Buena Vista, Fla., 8 Dec. 1985 Prepared in cooperation with Oak Ridge National Lab., Tenn.
(Contract DE-AC05-84OR-21400)
(DE86-003006; CONF-851238-3) Avail: NTIS HC A02/MF A01

A method based on the photoacoustic technique is described for dither-free frequency stabilization of the optical pump in a CH3OH laser operating at 119 (MU)m. Heterodyne measurements on two independently locked FIR lasers indicate excellent long-term frequency and power stability. This stabilization scheme should be applicable to all optically pumped FIR lasants. DOE

N86-23928# Martin Marietta Energy Systems, Inc., Oak Ridge, Tenn.
LASER-INDUCED FLUORESCENCE OF EUROPIUM-DOPED YTTRIUM OXIDE FOR REMOTE HIGH-TEMPERATURE THERMOMETRY
M. R. Cates, S. W. Allison, L. A. Franks, H. M. Borella, B. R. Marshall, and B. W. Noel 1985 6 p Presented at the ICALEO International Congress on the Applications of Lasers and Electro-optics, San Francisco, Calif., 11 Nov. 1985 Prepared in cooperation with EG and G Energy Measurements, Inc., Goleta, Calif.; Los Alamos National Lab., N. Mex.
(Contract DE-AC08-83NV-10282)
(DE86-003028; EGG-10282-2083; CONF-8511103-3) Avail: NTIS HC A02/MF A01

The refractory, Y2O3, doped with Eu, is suitable for high-temperature surface thermometry when activated by a UV laser. The 612-nm fluorescence lifetime has a logarithmic dependence with temperature from about 700(0)C to beyond 930(0)C. Many applications are possible, with specific emphasis on rapidly rotating turbine components operating at high temperatures. DOE

N86-23929# Max-Planck-Inst. fuer Quantenoptik, Munich (West Germany).
PROGRESS WITH THE GARCHING (WEST GERMANY) 30 METER PROTOTYPE FOR A GRAVITATIONAL WAVE DETECTOR
David Shoemaker, Walter Winkler, Karl Maischberger, Albrecht Ruediger, Roland Schilling, and Lise Schnupp Aug. 1985 13 p refs Presented at 4th Marcel Grossmann Meeting, Rome, Italy, Jun. 1985
(MPQ-100) Avail: NTIS HC A02/MF A01

Mechanical noise, thermally or seismically driven, in a 30 m gravitational wave detector was considerably reduced by separate (extremely simple) suspensions for the two near mirrors and the beam splitter. Fluctuations in laser beam geometry were efficiently reduced by using a single-mode fiber that ends in the vacuum on a (separately suspended) beam-steering block. Laser frequency stabilization was considerably improved in a second control loop, using the total optical path in the interferometer as reference. The interferometer was operated with 50 and 110 beams in the delay line (optical paths of 1.5 and 3.3 km, respectively). From 500 Hz to 6kHz, the noise measured is close to the shot noise for the 100 mW of available light power. Resonance peaks around 10 kHz were identified as being due to the Pockels cell mounting. From 1 kHz downward, a gradual increase in noise is observed, the origin of which is not known. Improvements in the isolation from ground noise and increases in light power will help to identify the sources of the remaining excess noise. Author (ESA)

N86-24372# Joint Publications Research Service, Arlington, Va.
WORK ON FEMTOSECOND LASERS AT VILNYUS UNIVERSITY VIEWED Abstract Only
Algis Piskarskas *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-004) 7 Feb. 1986 p 27 Transl. into ENGLISH from KomsomolskayaPravda (Moscow, USSR), no. 1, 1 Jan. 1985 p 1 (For primary document see N86-24358 14-70)
Avail: NTIS HC A06

N86-24373# Joint Publications Research Service, Arlington, Va.
NUMERICAL MODELING OF CHARACTERISTICS OF CO-2 WAVEGUIDE LASER Abstract Only
Yu. B. Konev, N. I. Lipatov, P. P. Pashinin, and A. M. Prokhorov *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-004) 7 Feb. 1986 p 30 Transl. into ENGLISH from Akademiya Nauk SSSR Inst. Obshchey Fiziki (Moscow, USSR), no. 44 (For primary document see N86-24358 14-70)
Avail: NTIS HC A06

N86-24374# Joint Publications Research Service, Arlington, Va.
LASER WITH DYNAMIC DISTRIBUTED FEEDBACK FORMED BY COUNTER-PROPAGATING PUMPING BEAMS Abstract Only
M. V. Bondar, L. V. Vovk, Ya. I. Zabello, and Ye. A. Tikhonov *In its* USSR Report: Physics and Mathematics (JPRS-PUM-86-004) 7 Feb. 1986 p 31 Transl. into ENGLISH from Ukrainskiy Fizicheskiy Zhurnal (Kiev, USSR), v. 29, no. 7, 1984 p 988-993

(For primary document see N86-24358 14-70)
Avail: NTIS HC A06

N86-24375# Joint Publications Research Service, Arlington, Va.
INFLUENCE OF GEOMETRY OF ACTIVE ELEMENT ON RADIATION PARAMETERS OF GAS-DISCHARGE LASERS Abstract Only
V. Ye. Privalov and Ye. G. Chulyayeva *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-004) 7 Feb. 1986 p 34 Transl. into ENGLISH from Optika I Spektroskopiya (Leningrad, USSR), v. 57, no. 6, Dec. 1984 p 1056-1059 (For primary document see N86-24358 14-70)
Avail: NTIS HC A06

N86-24376# Joint Publications Research Service, Arlington, Va.
BLEACHING OF COLOR CENTERS IN NEODYMIUM GLASS LASER Abstract Only
M. I. Dzhibladzye, G. G. Mshvelidzye, R. R. Erikashvili, and Z. G. Esiashvili *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-004) 7 Feb. 1986 p 36 Transl. into ENGLISH from Soobshcheniya Akademii Nauk Gruzinskoy SSR (Tbilisi, USSR), v. 115, no. 2, Aug. 1985 p 265-268 (For primary document see N86-24358 14-70)
Avail: NTIS HC A06

N86-24377# Joint Publications Research Service, Arlington, Va.
THRESHOLD CONDITIONS FOR IGNITION AND PROPAGATION OF OPTICAL DISCHARGE IN NEODYMIUM LASER BEAM Abstract Only
I. A. Bufetov, A. M. Prokhorov, V. B. Fedorov, and V. K. Fomin *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-004) 7 Feb. 1986 p 38 Transl. into ENGLISH from Zhurnal Tekhnicheskiy Fiziki (Leningrad, USSR), v. 55, no. 1, Jan. 1985 p 96-102 (For primary document see N86-24358 14-70)
Avail: NTIS HC A06

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N86-23930 California Univ., Berkeley.
DESIGN OF EXTERNALLY PRESSURIZED GAS BEARINGS FOR DYNAMIC APPLICATIONS Ph.D. Thesis
Jeffrey William Roblee 1985 209 p
Avail: Univ. Microfilms Order No. DA8525106

The dynamic stiffness of gas bearings over a broad frequency range was predicted and show that externally pressurized gas bearings can exhibit significant damping when properly designed. A new hybrid model of the dynamic stiffness of externally pressurized gas bearings is developed that incorporates the dominant distributed parameter characteristics of the bearing. This is accomplished by extending the analysis of squeeze films to include time-dependent-pressure boundary conditions and by linearly approximating the nonlinear frequency dependence of the flowrate and load solutions, including the geometry of the film. A dimensionless formulation of the model isolates the dominant bearing parameters to the extent possible and facilitates the dynamic analysis of thrust bearings with a large interior region. The model is validated by numerical analyses and by experiments. The hybrid model of dynamic stiffness is more accurate than a lumped parameter model over a wide frequency range, and it maintains a linear frequency dependence, which eases bearing design. Dissert. Abstr.

N86-23931 Princeton Univ., N. J.
THE DYNAMICS OF DRY FRICTION DAMPED SYSTEMS Ph.D. Thesis
Aldo Anthony Ferri 1985 246 p
Avail: Univ. Microfilms Order No. DA8529034

Dry friction damping has received considerable interest from the designers of turbomachinery and aerospace structures as a means of suppressing free vibration, limiting structure response to forced excitation and improving the stability of potentially unstable systems. Several types of dry friction damped systems are considered. Single and multiple-degree-of-freedom systems under harmonic excitation are studied analytically using traditional, one harmonic techniques and nontraditional, multiharmonic techniques. Results are compared with time integration results and with experimental results. It is found that frequency domain techniques can be very effective in studying the behavior of dry friction damped systems. In particular, it is seen that a substantial improvement in accuracy can be obtained by including higher harmonics in the analysis. An examination of the ability of dry friction damping to suppress flutter in turbine and compressor blades is also performed. Dissert. Abstr.

N86-23932 Texas A&M Univ., College Station.
ANALYSIS AND TESTING FOR ROTORDYNAMIC COEFFICIENTS OF GROOVED TURBULENT ANNULAR SEALS Ph.D. Thesis
Chang-Ho Kim 1985 186 p
Avail: Univ. Microfilms Order No. DA8528337

An analysis for turbulent grooved seals which are the most common design in commercial pumps was developed and tested to predict leakage and dynamic coefficients, as related to rotor dynamics. The grooved surface roughness pattern is formulated as an inhomogeneous directivity in surface shear stresses. The governing equations are expanded in the eccentricity ratio to yield zeroth and first-order perturbation solutions. Comparisons between analysis and experimental data are carried out in terms of effective stiffness, effective damping, and effective inertia coefficients for both tapered and constant-clearance circumferentially-grooved seals. Agreement between test results and analysis for net-damping coefficients is satisfactory, but the stiffness predictions have mixed results. Analytical results are presented for helically-grooved seals in the High Pressure Oxygen Turbopump (HPOTP) of the Space Shuttle Main Engine (SSME) to determine the influence of seal parameters on dynamic coefficients, stability estimates, leakage performance, and power consumption. The proper selection of seal parameters improves the seal performance in terms of leakage and stability. Dissert. Abstr.

N86-23933 Iowa Univ., Iowa City.
DYNAMIC ANALYSIS AND CONTROL SYNTHESIS OF INTEGRATED MECHANICAL SYSTEMS Ph.D. Thesis
Dwo-Gee Liang 1985 190 p
Avail: Univ. Microfilms Order No. DA8527981

A general methodology for dynamic analysis and control synthesis of integrated mechanical/control/hydraulic systems is presented. A control/hydraulic simulation program is developed for either independent simulation of control systems or integral simulation of controlled mechanical systems in conjunction with a general mechanical systems simulation program. The system topology is automatically identified by processing a symbolic loop matrix that represents the algebraic relationship between the internal control node variables. This process yields a minimal set of state variables resulting in more efficiency in numerical calculations. A geometric approach to the solution of the dynamic response of constrained mechanical systems is proposed. A continuous and differentiable basis of the constraint null space is automatically generated using the Gram-Schmidt process. A state space decomposition method is proposed to synthesize a control that will allow an arbitrary system trajectory to be specified. Examples are presented to demonstrate the generality and effectiveness of the proposed methods and the computer program. Dissert. Abstr.

N86-23934 Cincinnati Univ., Ohio.
COMPUTER-AIDED DESIGN AND ANALYSIS OF SPUR GEAR DYNAMICS Ph.D. Thesis
Hsiang-Hsi Lin 1985 184 p
Avail: Univ. Microfilms Order No. DA8526564

An analytical approach, developed specifically for application of computer in the design and analysis of spur gear systems, is

presented. This method and associated computer program are capable of determining the dynamic response of spur gear systems with involute tooth profile and normal contact ratio. Various parameters affecting the system dynamic behavior were examined. Results generated from the computer program were compared with semi-empirical formula AGMA formula, and experimental data. Good correlation existed between the experimental results and the computer simulation. Two design approaches were proposed to reduce dynamic response within system operating speed-range. One used geometric modification of gear tooth profile. The other used modification of system mass and stiffness distributions. Some examples showed that the proposed design approaches were effective. Dissert. Abstr.

N86-23935 Department of the Air Force, Washington, D.C.
FUEL VAPOR GENERATOR Patent
Vann Y. Won, inventor (to Air Force) Issued 5 Nov. 1985 9 p (AD-D012081; US-Patent-4,551,153; US-Patent-Appl-SN-586956; US-Patent-Class-48-102R) Avail: US Patent and Trademark Office CSCL 13/6

A fuel vapor generator capable of being incorporated within a carburetor having a housing defining a chamber at the bottom thereof. An input line is attached to the lower portion of the housing for removing any excess liquid from the chamber and returning the excess liquid to the chamber. Located within the chamber is a level regulating system which, by being operably connected to both the inlet and removal lines is capable of regulating the liquid level within the chamber. In addition, an atomizer is located within the chamber in order to spray the liquid fuel in mist form into the upper portion of the housing for vaporization thereof prior to introduction into the Venturi tube of a carburetor. GRA

N86-23936*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Business Group.
EXTENDED PARAMETRIC REPRESENTATION OF COMPRESSOR FANS AND TURBINES. VOLUME 1: CMGEN USER'S MANUAL Final Report, Aug. 1982 - Oct. 1983
G. L. Converse and R. G. Giffin Mar. 1984 60 p refs 3 Vol.
(Contract NAS3-23055)
(NASA-CR-174645; NAS 1.26:174645; R84AEB378-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 13I

A modeling technique for fans, boosters, and compressors has been developed which will enable the user to obtain consistent and rapid off-design performance from design point input. The fans and compressors are assumed to be multi-stage machines incorporating front variable stators. The boosters are assumed to be fixed geometry machines. The modeling technique has been incorporated into time sharing program to facilitate its use. Because this report contains a description of the input output data, values of typical inputs, and examples cases, it is suitable as a user's manual. This report is the first of a three volume set describing the parametric representation of compressors, fans, and turbines. The titles of the three volumes are as follows: (1) Volume 1 CMGEN USER's Manual (Parametric Compressor Generator); (2) Volume 2 PART USER's Manual (parametric Turbine); (3) Volume 3 MODFAN USER's Manual (Parametric Modulating Flow Fan).
Author

N86-23937*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Business Group.
EXTENDED PARAMETRIC REPRESENTATION OF COMPRESSOR FANS AND TURBINES. VOLUME 2: PART USER'S MANUAL (PARAMETRIC TURBINE) Final Report, Aug. 1982 - Oct. 1983
G. L. Converse Mar. 1984 61 p refs 3 Vol.
(Contract NAS3-23055)
(NASA-CR-174646; NAS 1.26:174646; R84AEB379-Vol-2) Avail: NTIS HC A04/MF A01 CSCL 13I

A turbine modeling technique has been developed which will enable the user to obtain consistent and rapid off-design performance from design point input. This technique is applicable to both axial and radial flow turbine with flow sizes ranging from about one pound per second to several hundred pounds per second. The axial flow turbines may or may not include variable geometry in the first stage nozzle. A user-specified option will also permit the calculation of design point cooling flow levels and corresponding changes in efficiency for the axial flow turbines. The modeling technique has been incorporated into a time-sharing program in order to facilitate its use. Because this report contains a description of the input output data, values of typical inputs, and example cases, it is suitable as a user's manual. This report is the second of a three volume set. The titles of the three volumes are as follows: (1) Volume 1 CMGEN USER's Manual (Parametric Compressor Generator); (2) Volume 2 PART USER's Manual (Parametric Turbine); (3) Volume 3 MODFAN USER's Manual (Parametric Modulation Flow Fan). Author

N86-23938*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Business Group.
EXTENDED PARAMETRIC REPRESENTATION OF COMPRESSOR FANS AND TURBINES. VOLUME 3: MODFAN USER'S MANUAL (PARAMETRIC MODULATING FLOW FAN) Final Report, Aug. 1982 - Oct. 1983
G. L. Converse Mar. 1984 50 p refs 3 Vol.
(Contract NAS3-23055)
(NASA-CR-174647; NAS 1.26:174647; R84AEB380-Vol-3) Avail: NTIS HC A03/MF A01 CSCL 13I

A modeling technique for single stage flow modulating fans or centrifugal compressors has been developed which will enable the user to obtain consistent and rapid off-design performnce from design point input. The fan flow modulation may be obtained by either a VIGV (variable inlet guide vane) or a VPF (variable pitch rotor) option. Only the VIGV option is available for the centrifugal compressor. The modeling technique has been incorporated into a time-sharing program to facilitate its use. Because this report contains a description of the input output data, values of typical inputs, and examples cases, it is suitable as a user's manual. This report is the last of a three volume set describing the parametric representation of compressor fans, and turbines. The titles of the three volumes are as follows: (1) Volume 1 CMGEN USER's Manual (Parametric Compressor Generator); (2) Volume 2 PART USER's Manual (Parametric Turbine); (3) Volume 3 MODFAN USER's Manual (Parametric Modulating Flow Fan).
Author

N86-23939*# Spectra Research Systems, Inc., Huntsville, Ala. Aerospace and Commercial Systems Dept.
BEARING TESTER DATA COMPILATION, ANALYSIS, AND REPORTING AND BEARING MATH MODELING Annual Report
Jan. 1986 117 p refs
(Contract NAS8-36183)
(NASA-CR-178748; NAS 1.26:178748; SRS/STD-TR86-014-535) Avail: NTIS HC A06/MF A01 CSCL 13I

A test condition data base was developed for the Bearing and Seal Materials Tester (BSMT) program which permits rapid retrieval of test data for trend analysis and evaluation. A model was developed for the Space shuttle Main Engine (SSME) Liquid Oxygen (LOX) turbopump shaft/bearing system. The model was used to perform parametric analyses to determine the sensitivity of bearing operating characteristics and temperatures to variations in: axial preload, contact friction, coolant flow and subcooling, heat transfer coefficients, outer race misalignments, and outer race to isolator clearances. The bearing program ADORE (Advanced Dynamics of Rolling Elements) was installed on the UNIVAC 1100/80 computer system and is operational. ADORE is an advanced FORTRAN computer program for the real time simulation of the dynamic performance of rolling bearings. A model of the 57 mm turbine-end bearing is currently being checked out. Analyses were conducted to estimate flow work energy for several flow diverter configurations and coolant flow rates for the LOX BSMT.
B.G.

N86-23940*# Texas A&M Univ., College Station. Dept. of Mechanical Engineering.
SSME SEAL TEST PROGRAM: TEST RESULTS FOR SAW-

TOOTH PATTERN DAMPER SEAL Interim Progress Report
Dara W. Childs Feb. 1986 101 p refs
(Contract NAS8-35824)
(NASA-CR-178801; NAS 1.26:178801; TRC-Seal-1-86) Avail: NTIS HC A06/MF A01 CSCL 11A

Direct and transverse force coefficients for 11, sawtooth-pattern, and damper-seal configurations were examined. The designation damper seal uses a deliberately roughened stator and smooth rotor to increase the net damping force developed by a seal. The designation sawtooth-pattern refers to a stator roughness pattern. The sawtooth pattern yields axial grooves in the stator which are interrupted by spacer elements which act as flow constrictions or dams. All seals use the same smooth rotor and have the same, constant, minimum clearance. The stators examined the consequences of changes in the following design parameters: (1) axial-groove depth; (2) number of teeth: (3) number of sawtooth sections; (4) number of spacer elements; (5) dam width; (6) axially aligned sawtooth sections versus axially-staggered sawtooth sections; and (7) groove geometry. It is found that none of the sawtooth-pattern seal performs as well as the best round-hole-pattern seal. Maximum damping configurations for the sawtooth and round-hole-pattern stators have comparable stiffness performance. Several of the sawtooth pattern stators outperformed the best round-hole pattern seal. E.A.K.

N86-23941# Duke Univ., Durham, N. C. Dept. of Civil and Environmental Engineering.
COMPLIANT ROBOTIC STRUCTURES Report, 1 Jun. 1984 - 31 May 1985
James F. Wilson Aug. 1985 128 p
(Contract MDA903-84-C-0243; ARPA Order 5092)
(AD-A161897; DUKE-CE-001-85-1; R-1) Avail: NTIS HC A07/MF A01 CSCL 13/9

A complaint robotic structure is one or more continuously flexible arms that can be controlled to manipulate objects. A typical arm is comprised of orthotropic tube elements placed end-to-end where each element is designed to move in a particular way (bend, twist or extend) when pressurized. The results of the first year studies are reported in three chapters. Chapter 1 focuses on the mechanics and structure of an elephant trunk. Chapter 2 involves the analysis of computer controlled compliant element systems that bend and coil similar to elephant trunks. Chapter 3 focuses on the analysis of compliant orthotropic tube elements that can be used as torsion actuators when pressurized. GRA

N86-23942# Aeronautical Research Labs., Melbourne (Australia).
A PRELIMINARY EVALUATION OF SOME GEAR DIAGNOSTICS USING VIBRATION ANALYSIS
S. C. Favaloro Jul. 1985 28 p
(AD-A161939; ARL-AERO-RPOP-TM-427) Avail: NTIS HC A03/MF A01 CSCL 13/8

Several conditions monitoring methods for gears, which use the signal average of gear vibrations in both the time and frequency domain, have been investigated during a 1500 hour test on a gear rig. Results have shown that although heavy wear, in the form of fine pitting and scuffing, occurred over most of the tooth surfaces, the time domain procedures and levels of the fundamental and first harmonic of meshing frequency did not respond to damage to the gears. Total vibration and the ratio of sideband to total energy showed only marginal response to wear. GRA

N86-23943# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Geotechnical Lab.
RELIABILITY OF THE FLEXIBLE PAVEMENT DESIGN MODEL Final Report
John C. Potter Sep. 1985 22 p
(AD-A162004; WES/MP/GL-85-27) Avail: NTIS HC A02/MF A01 CSCL 13/2

The design of flexible pavements by the US Army Corps of Engineers is currently based on the California bearing ratio (CBR) curve. The CBR curve is empirical, and the current design approach is deterministic. A probabilistic approach, providing more reliable designs at potentially lower costs, can be developed from the current design procedure, except that the reliability of the CBR curve is uncertain. This study was undertaken to establish the reliability of the current CBR-based flexible pavement design model, using existing data from accelerated traffic tests. The reliability of the design model was found to be 50 percent, excluding the effects of conservative estimates of the design parameters. GRA

N86-23944# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Structures Lab.
EFFECTS OF REINFORCEMENT CONFIGURATION ON RESERVE CAPACITY OF CONCRETE SLABS Final Report
S. C. Woodson and S. B. Garner Aug. 1985 117 p
(AD-A162155; WES/TR/SL-85-5) Avail: NTIS HC A06/MF A01 CSCL 13/3

Fifteen one-way reinforced concrete slabs were statically tested under uniform surface pressure either to failure, or to deflections that exceeded 17 to 24 percent of slab clear span. The main objective was to determine principal reinforcement configurations that would enhance tensile membrane behavior at large deflections. Each slab had a clear span of 24 inches and was 2-5/16 inches thick. Grade-60 reinforcement and 4,000-psi concrete were used. The total amount of principal reinforcement was about the same in every test, but the percentages of reinforcement in tension and compression zones were varied. The slabs were supported in a reaction structure and restrained at the supports. A modified three-hinged mechanism was formed, and rupture of reinforcement prohibited the development of pure tensile membrane behavior in most of the slabs. Posttest analysis applying tensile membrane theory agreed with the experimental tensile membrane slope, when the area of ruptured reinforcement was deleted. Based on these test results, principal reinforcement details were recommended for a blast shelter roof slab design. GRA

N86-23945# Clarkson Univ., Potsdam, N.Y. Dept. of Mechanical and Industrial Engineering.
NONLINEAR ANALYSIS AND OPTIMAL DESIGN OF DYNAMIC MECHANICAL SYSTEMS FOR SPACECRAFT APPLICATION Annual Technical Report, 1 Feb. 1984 - 31 Jan. 1985
K. D. Wilmert and M. Sathyamoorthy Feb. 1985 32 p
(Grant AF-AFOSR-0076-84)
(AD-A162194; AFOSR-85-1017TR) Avail: NTIS HC A03/MF A01 CSCL 20/11

A nonlinear finite element procedure has been developed for the dynamic vibrational analysis of planar mechanisms. The analysis takes into account the effects of geometric and material nonlinearities, vibrational effects and coupling of deformations. The effects of nonlinearities have been found to be significant on the dynamic behavior. Due to the complex nature of this nonlinear analysis procedure, an efficient optimal design approach using an optimality criterion technique was developed. The new optimization technique, called the Gauss Nonlinearly Constrained Technique, was developed in such a way that is applicable to design problems with nonlinear objective functions and constraints. The applicability of this method has been demonstrated with example problems consisting of objective functions of various complexities. Complete details of the nonlinear finite element procedure as well as the optimization technique are available in the appendix. GRA

N86-23946# Carnegie-Mellon Univ., Pittsburgh, Pa. Robotics Inst.
THE MOTION OF A PUSHED, SLIDING OBJECT. PART 1: SLIDING FRICTION Interim Report
M. A. Peshkin and A. C. Sanderson Sep. 1985 54 p
(AD-A162276; CMU-RI-TR-85-18-Pt-1) Avail: NTIS HC A04/MF A01 CSCL 20/11

In many robotic applications, manipulation planning for an object free to slide on a surface is an important problem. Physical analysis of the object's motion is made difficult by the absence of information about the distribution of support of the object, and of the resulting frictional forces. This paper describes a new approach to the analysis of sliding motion. The instantaneous motion of the object can be described as a pure rotation about a center of rotation (COR) somewhere in the plane. In this paper we find the

locus of CORs for all possible distributions of support forces. We assume zero friction at the pusher-object contact, and we assume that the support force distribution is confined to a disk. In one application to robotic manipulation, bounds on the distance an object must be pushed to come into alignment with robot finger or a fence are determined. Author (GRA)

N86-23947# Alabama Univ., Huntsville. Dept. of Engineering Mechanics.
CONCEPTUAL DESIGN OF A ROBOTIC LOADER SYSTEM FOR REMOTE MISSILE LAUNCHERS
James L. Hill and Charles W. Warren Sep. 1985 85 p Supersedes report dated May 1983, AD-A141270
(Contract DAAH01-83-P-1020)
(AD-A162341; CR-84-1; AMSMI/RL-AD-E950771) Avail: NTIS HC A05/MF A01 CSCL 16/1

This report deals with the conceptual design of a robotic missile reloading system. This system will be the supply center for several unmanned, remotely controlled missile launchers. The supply center will contain robot equipment sufficient to handle the task of reloading the missile. The motivation for this is to accomplish the reloading in a minimum of time with a minimum of manpower. A review of the major robot configurations is given followed by several ideas for grippers and sensing procedures. A final conceptual design is presented after each of the systems components have been scrutinized. An extensive survey of the state of technology in robotics and application of robotic equipment was conducted. The survey included technical literature as well as product literature obtained from robotics manufacturers. Author (GRA)

N86-23948# Rensselaer Polytechnic Inst., Troy, N.Y. School of Engineering.
A LASER TRIANGULATION RANGING SYSTEM FOR MOBILE ROBOTS
Albert Lester Hoogeveen May 1983 57 p
(Contract MDA903-82-K-0168; DARPA Order 4467)
(AD-A162846; RPI-MP-81) Avail: NTIS HC A04/MF A01 CSCL 17/7

A laser triangulation system for short range obstacle avoidance for mobile robots is discussed. The system was designed as an improvement over an earlier laser triangulation system. The new system was designed for use with an Adaptive Suspension Vehicle and the Mars Roving Vehicle; however, the new system is not limited to these two applications. A system overview is given, and then each component is discussed in detail. This report has discussed new scanning techniques and shown the feasibility of these in a new Multilaser/Multidetector system (ML/MD) laser triangulation system. A holographic scanner is used for rapid azimuth scanning, a galvanometric scanner is used for elevation scanning, special optics and optical fibers are used with individual detectors, a high power laser diode is used as the laser source, and a microprocessor and programmable timing module are used to control the system operation. Each element in the system is an improvement over existing scanning elements. And when a prototype is constructed, the author is fairly confident that the improvement over the existing ML/MD system will be tremendous. The new system should demonstrate high scan rates, high efficiencies, greater scan ranges, faster data collection, and greater flexibility. GRA

N86-23949# Department of the Navy, Washington, D. C.
MOORING LINE LOCKUP MECHANISM Patent Application
Robert G. Walden, inventor (to Navy) Filed 27 Aug. 1985 16 p
(AD-D012054; US-Patent-Appl-SN-644475) Avail: NTIS HC A02/MF A01 CSCL 08/10

An Air Deployed Oceanographic Mooring when assembled for deployment has a multitude of components suitable for separation by explosive bolts upon deployment of the system. A parachute system is connected to a surface buoy. The components that separate from each other upon deployment comprise a parachute system, a surface float, a subsurface buoy, an anchor shell and a bottom finder. All components except for the parachute system have interconnecting flexible lines upon deployment. A novel locking mechanism for limiting the paying out of the line between the anchor shell and subsurface buoy is triggered by the slackening of the line between the bottom finder and anchor shell when the bottom finder hits the bottom of the ocean. Author (GRA)

N86-23950# Department of the Navy, Washington, D. C.
ANCHORING SYSTEM FOR CONCRETE FLOATING PIER Patent Application
Tung Y. Lin, inventor (to Navy) Filed 22 Jul. 1985 16 p
(AD-D012074; US-Patent-Appl-SN-757402) Avail: NTIS HC A02/MF A01 CSCL 13/2

The present invention relates to floating piers and particularly to a system for anchoring a concrete floating piers and similar marine structures. The device is a floating pier with a sliding pile anchoring system arrangement that avoids rigid connections to the pier and allows the pier to rise and lower with the tides and to remain level during lateral displacement while avoiding substantial tilt or rotation of the pier during seismic and maximum static loading. Preferrably, piles that are arranged in pairs and are spaced along the centerline of the floating pier ride in pile guide assemblies attached to the pier deck, and include shear fail means which operate during overload conditions. GRA

N86-23951# Southwest Research Inst., San Antonio, Tex.
INVESTIGATION OF THE POTENTIAL FOR IMPROVING THE EFFICIENCY OF A SPARK-IGNITION ENGINE OPERATING ON NATURAL GAS FUEL Final Report
Oct. 1985 117 p
(Contract DE-AC01-84CE-50072)
(DE86-002090; DOE/CE-50072/1) Avail: NTIS HC A06/MF A01

Since natural gas (mostly methane) is readily available and enjoys a favorable cost advantage through lower taxes and some price regulations, the popularity of conversion of gasoline engines to natural gas has increased significantly in recent years. However, fuel cost rather than energy efficiency has been the primary motivation behind these engine conversions, and little emphasis has been placed on the anti-knock, wide flammability, and emissions characteristics of methane. A data base was established in Phase 1 utilizing a wedge-shaped combustion chamber to show effects of equivalence ratio, ignition timing, and compression ratio for engine operation on natural gas whose primary component was methane. Baseline performance data were obtained for engine operation on research grade indolene and natural gas. The reoptimization process for the engine operating on natural gas fuel included determining minimum best torque spark timing as a function of equivalence ratio from 120% of the stoichiometric fuel rate to the lean limit fuel rate for a range of compression ratios from 8.4:1 to 18.5:1. The optimum compression ratio for the wedge-shaped combustion chamber was selected based on data for both part throttle and wide-open throttle operation. In Phase 2, a hemispherical combustion chamber was used to show the effects of changing combustion chamber configuration on the pertinent engine operating parameters. DOE

N86-23952# Oak Ridge National Lab., Tenn.
CLEAN VACUUM SYSTEMS FOR RFTF
R. L. Livesey 1985 4 p Presented at the 32nd National Vacuum Symposium and Topical Conference, Houston, Tex., 19 Nov. 1985
(Contract DE-AC05-84OR-21400)
(DE86-002448; CONF-851174-13) Avail: NTIS HC A02/MF A01

The three vacuum systems to be used on the test facility are briefly described and their performance noted. DOE

N86-23953# Lawrence Livermore National Lab., Calif.
DESIGN OF EXTERNALLY PRESSURIZED GAS BEARINGS FOR DYNAMIC APPLICATIONS
J. W. Roblee 30 Sep. 1985 211 p
(Contract W-7405-eng-48)
(DE86-003443; UCRL-53643) Avail: NTIS HC A10/MF A01

Externally pressurized gas bearings are a common element in machines. Because the transverse vibration of externally pressurized gas bearings exhibits damping only over a narrow frequency

band, gas bearings are reputed to be poorly damped. In addition, no systematic design procedure for the frequency-dependent damping is available. This work accurately predicts the dynamic stiffness of gas bearings over a broad frequency range, and shows that externally pressurized gas bearings can exhibit significant damping when properly designed. DOE

N86-23954# New Mexico Univ., Albuquerque.
TASK PLANNING FOR CONTROL OF A SENSOR-BASED ROBOT
R. C. Lennox, G. F. Luger, and R. W. Harrigan Dec. 1985 36 p Prepared in cooperation with Sandia National Labs., Albuquerque, N. Mex.
(Contract DE-AC04-76DP-00789)
(DE86-004225; SAND-85-0958) Avail: NTIS HC A03/MF A01

This paper is divided into four major sections. The first is an introduction to the research area. The second provides a brief overview of the history of planning in artificial intelligence (AI), while the third part of the paper describes the representational power of very-high-level computer languages and how this power may be brought to planning in robotics research. Finally, we describe our PROLOG-driven Planner for controlling a PUMA arm used for object manipulation and note the future directions of this work. DOE

N86-23955# Southampton Univ. (England). Inst. of Sound and Vibration Research.
ON THE PREDICTION OF LOSS FACTORS DUE TO SQUEEZE FILM DAMPING MECHANISMS
L. C. Chow and R. J. Pinnington Oct. 1985 88 p refs Sponsored by UK Science and Engineering Research Council
(ISVR-TR-130) Avail: NTIS HC A05/MF A01

Machinery panels were damped by attaching an auxiliary plate parallel to the surface, thereby trapping a thin layer of air. Relative vibration of the plates pumps this air at high velocities, resulting in energy loss due to the air viscosity. Loss factors of the order of 0.1 are achieved without the sensitivity to heat and oil associated with viscoelastic materials. The damping over the whole frequency range above and below critical was measured and compared with prediction. The agreement in results is remarkably good. Below the critical frequency, the damping is pumping controled, while above critical the plate couplings are the controlling factor.
Author (ESA)

N86-23956# Wyle Labs., Inc., Huntsville, Ala.
TEST PROCEDURE FOR CONTAINER SPECIFICATION 49 CFR 178.51 WELDED OR BRAZED STEEL CYLINDERS MADE OF DEFINITELY PRESCRIBED STEELS (4BA)
Sep. 1985 47 p Sponsored in part by DOT, Washington, D.C.
(PB86-111655; DOT/RSPA/DMT12-84/30) Avail: NTIS HC A03/MF A01 CSCL 13D

The test procedure to test containers meeting DOT Specifications (4BA) are described. The Test Procedure is designed to determine whether or not a given 4BA container meets the safety aspects of the Hazardous Materials Transportation Act of 1974 (P.L. 93-633) and the rules and regulations for the manufacture and testing of containers contained in the Federal Register (49 CFR 178.51). The Test Procedure describes the tests to be conducted by the Office of Operations and Enforcement, Materials Transportation Bureau to verify that manufacturers of containers are producing products that comply with the rules and regulations contained in the Federal Register (49 CFR 178.51). GRA

N86-23772# Joint Publications Research Service, Arlington, Va.
TRANSPORT MANIPULATOR REVIEWED
V. Dzyuba, A. S. Mironenko, L. N. Timoshenko, and V. Ye. Kovtunenko *In its* USSR Report: Machine Tools and Metalworking Equipment (JPRS-UMM-86-007) 21 Mar. 1986 p 60-63 Transl. into ENGLISH from Mekhanizatsiya i Avtomatizatsiya Proizvodstva (Moscow, USSR), no. 11, Nov. 1985 p 13-14 (For primary document see N86-23768 14-31)
Avail: NTIS HC A04/MF A01

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N86-23957*# Massachusetts Inst. of Tech., Cambridge. Space Systems Lab.
A GEOMETRIC APPROACH TO FAILURE DETECTION AND IDENTIFICATION IN LINEAR SYSTEMS
Mohammad-Ali Massoumnia Feb. 1986 187 p refs
(Grant NAG1-126)
(NASA-CR-176750; NAS 1.26:176750; SSL-5-86) Avail: NTIS HC A09/MF A01 CSCL 14D

Using concepts of (C,A)-invariant and unobservability (complementary observability) subspaces, a geometric formulation of the failure detection and identification filter problem is stated. Using these geometric concepts, it is shown that it is possible to design a causal linear time-invariant processor that can be used to detect and uniquely identify a component failure in a linear time-invariant system, assuming: (1) The components can fail simultaneously, and (2) The components can fail only one at a time. In addition, a geometric formulation of Beard's failure detection filter problem is stated. This new formulation completely clarifies of output separability and mutual detectability introduced by Beard and also exploits the dual relationship between a restricted version of the failure detection and identification problem and the control decoupling problem. Moreover, the frequency domain interpretation of the results is used to relate the concepts of failure sensitive observers with the generalized parity relations introduced by Chow. This interpretation unifies the various failure detection and identification concepts and design procedures. Author

N86-23958# City Coll. of the City Univ. of New York. Dept. of Mathematics.
RELIABILITY ASSESSMENT FOR SYSTEMS SUBJECT TO MAINTENANCE AND REPAIR Annual Report, 1 Apr. 1984 - 30 Jun. 1985
Mark Brown Aug. 1985 9 p
(Grant AF-AFOSR-0095-84)
(AD-A162029; AFOSR-85-1084TR) Avail: NTIS HC A02/MF A01 CSCL 14/4

The main thrust of the research under this grant is to develop the methodology to deal with more realistic models for the quantitative reliability assessment and analysis of complex systems. Inequalities for increasing failure rate distributions have been derived. A new theory of age-weighted distributions is being developed. Work is beginning on exploiting properties of a partial ordering of distribution. GRA

N86-23959# California Univ., Los Angeles. Graduate School of Management.
SEQUENTIAL DECISION MODELS IN RELIABILITY Final Report, 1 Oct. 1982 - 30 Sep. 1985
Bruce L. Miller 31 Oct. 1985 7 p
(Grant AF-AFOSR-0305-82)
(AD-A162332; AFOSR-85-1093TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

The research topics under this grant included optimal stockage policies for parts which replaced failed components, optimal inspection policies, quality control, and queuing theory applications to inventory. The common thread of this research is the sequential or dynamic aspect of reliability problems. This dynamic aspect showed up in various ways: What order to examine components of a failed part. What ordering rules to use for the failed parts, taking into account that it is is possible to order again later in the future. The mathematical technique applied to the above problems was dynamic programming. When we shifted attention to quality control and the production of components, the dynamic aspect of the problem was still paramount. Now the question was to determine the quality level of a production process using past quality data. The mathematical technique applied to this problem

was time series. We have also considered the related decision problem of when the production process should be corrected.
GRA

N86-23960# Northwestern Univ., Evanston, Ill.
MONTE CARLO RELIABILITY ANALYSIS Annual Technical Report, 1 Sep. 1984 - 31 Aug. 1985
E. E. Lewis 4 Nov. 1985 3 p
(Grant AF-AFOSR-0340-84)
(AD-A162379; AFOSR-85-1092TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

The work carried out during the 1984/85 contract year is divided into two parts. First, three classes of component dependency models have been successfully incorporated into the Markov Monte Carlo formulation: standby systems, shared load systems and shared repair crews. These models have been implemented in a computer code and used for the analysis of a number of complex systems. Second, the investigation of the Monte Carlo simulation of time-dependent failure was begun. Two different sampling techniques were formulated, and evaluation is continuing into the 1985/86 contract period. Author (GRA)

N86-24526*# Jackson State Univ., Miss.
APPLICATION OF WEIBULL ANALYSIS TO SSME HARDWARE
Lou Allen Bell Gray *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 25 p refs (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 14D

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance.*

N86-23961 West Virginia Univ., Morgantown.
A FINITE ELEMENT SIMULATION OF ELASTO-PLASTIC CONTACT PROBLEMS Ph.D. Thesis
Steve H. Chang 1985 157 p
Avail: Univ. Microfilms Order No. DA8523762

A direct finite element method for elastoplastic bodies with isotropic and/or kinematic hardening was developed and used to study the influence of material plasticity on contact behavior. The method subdivides the problem into a series of conditions, each of which occurs over an increment in load. The sequence of conditions is decided by scaling the residual load so that either the contact region changes or the yeilded region grows and choosing that condition requiring minimum load. A cross product technique is used to detect contact and the von Mises criterion to determine yielding. Interpenetrations are prevented by two sets of constraint equations depending on smooth or rough surface contacts. After each condition, boundary conditions and material properties are updated to be consistent with the deformation and stress state. Phenomena are discovered for the two-dimensional Hertz problem. In plane strain, yielding initiates about 70% of the half contact length beneath the contact plane, but in plane stress, yielding initiates at the contact plane. As in elastic contact, friction plays a weak role in elastoplastic contact. Contact between elastoplastic bodies requires less load to develop the same contact extent as for elastic bodies and it distributes the pressure more evenly over the contact length. Dissert. Abstr.

N86-23962 Maryland Univ., College Park.
A MIXED FORMULATION TRIANGULAR FINITE ELEMENT MODEL FOR THIN SHELL ANALYSIS Ph.D. Thesis
Chung Chin Dai 1985 160 p
Avail: Univ. Microfilms Order No. DA8523068

A finite element modeling technique which utilizes a triangular element called TSHEL with 45 degrees of freedom and seven point integration was tested for analysis of thin plate and shell structures. The element formulation is based on the degenerate solid shell concept and the mixed formulation with assumed independent inplane and transverse shear strains. Numerical result indicates effectiveness of the present modeling technique which features combined use of elements with kinematic modes and those without kinematic modes in order to eliminate both locking and spurious kinematic modes at global structural level.
Dissert. Abstr.

N86-23963 Northwestern Univ., Evanston, Ill.
SCATTERING OF ULTRASONIC WAVES BY A SUBSURFACE CRACK AND DYNAMIC STRESS INTENSITY FACTORS Ph.D. Thesis
Weichuan Lin 1985 127 p
Avail: Univ. Microfilms Order No. DA8523557

The steady-state and transient scattering for a subsurface line crack in an homogeneous, isotropic and linearly elastic solid, which may be submerged in fluid, were investigated. The problem is formulated as one for plane strain. The problem is approached by the use of Green's function techniques in the frequency domain. The field generated by a line potential source is derived. The Green's function due to a line force is constructed in terms of the derived displacement potentials, and an integral representation for the scattered displacement field is obtained. By applying Hooke's law, coupled integral equations, which correlate the incident stresses and unknown dislocation densities, are constructed. Stress intensity factors at each crack tip are evaluated after numerically solving for the dislocation densities. The scattered field generated by dislocation densities is, then, obtained from the integral representation. The time domain response is obtained by using the fast Fourier transform. The results contain: (1) stress intensity factors due to the longitudinal and transverse waves applied on the surface; (2) steady-state and transient scattering for a subsurface crack for both near and far field; and (3) a simulation of the submerging test in which transducers and the testing solid are both submerged in a water bath. Dissert. Abstr.

N86-23964 Stanford Univ., Calif.
ASPECTS OF FRACTURE MECHANICS FOR ELASTIC SOLIDS COUPLED TO OTHER FIELDS Ph.D. Thesis
Yukeun Eugene Pak 1985 141 p
Avail: Univ. Microfilms Order No. DA8522209

In elastostatics, the energy-release rates associated with translation, rotation and self-similar expansion of cavities or cracks in solids are expressed by the path-independent integrals J, L and M, respectively. It is shown that, for a crack subjected to far field homogeneous stresses, and, an insulated crack disturbing a uniform heat flow, these integrals may be evaluated by first considering an elliptical cavity and then performing a limiting process. Employing this limiting process and using certain special properties of the M-integral makes it possible to find stress intensity factors without solving the corresponding boundary value problem. The elastic dielectric problem was considered to investigate whether the connection between path-independent integrals and energy release rates extends to continua coupled with other fields. An analogous path-independent integral is derived for a dielectric material subjected to an external electric field. To show that this integral has the same physical implication as the J-integral of elastostatics, the dielectric crack problem was solved. The solution is obtained by the use of an integral transform technique and the stresses are expressed in closed form. The crack extension force is evaluated. The critical external electric field which will cause unstable crack propagation for PMMA is predicted. Dissert. Abstr.

N86-23965 California Univ., Los Angeles.
ASYMMETRIC STEADY STATE ELASTIC WAVE SCATTERING BY GLOBAL LOCAL FINITE ELEMENT METHOD Ph.D. Thesis
Jeffrey Austin Clements 1985 84 p
Avail: Univ. Microfilms Order No. DA8525841

A Global Local Finite Element Method is developed for computing the scattering behavior of an oblique plane incident elastic wave propagating in a homogenous isotropic host medium.

The wave is assumed steady state and incident upon an axisymmetric inclusion having inhomogeneous orthotropic elastic material properties. Isoparametric Finite Elements are used to represent the inclusion. Global wave functions representing the incident and scattered field are used to match displacements and tractions at the Finite Element boundary. The method was verified, using a spherical inclusion for both compressional and shear waves, by comparing the results obtained by the current method with these obtained from exact solution also generated in this dissertation. The current method is applied to three classes of scattering problems which examined the effects of oblique plane incident waves, inclusion geometry variations, and spacing between adjacent circular cylindrical inclusion. All results are presented in terms of scattering cross sections to allow a consistent basis for comparisons. Dissert. Abstr.

N86-23966 Polish Academy of Sciences, Warsaw.
SOME PROBLEMS OF MULTICRITERIA OPTIMIZATION OF CABLE STRUCTURES
Stefan Jendo 1985 53 p refs
(ISSN-0208-5658) Avail: Issuing Activity

Multicriteria structural optimization of cable structures are discussed. A general formulation of multicriteria optimization problem is presented. Some applications concerning the simple and double layer-cable systems are considered. Minimum weight and maximum of the lowest natural frequency of free vibration are taken as optimization criteria. The permissible stresses and displacements are taken as behavioral constraints. The optimization problem is solved by nonlinear programming and metric function methods. E.A.K.

N86-23967 Texas Univ., Austin.
THE DETECTION AND QUANTITATIVE CHARACTERIZATION OF SUBCRITICAL CRACKS FROM ACOUSTIC EMISSION SOURCES Ph.D. Thesis
Hyman A. Feldstein 1985 183 p
Avail: Univ. Microfilms Order No. DA8527561

Experimental results are presented when three simultaneous acoustic emission measurements: sum of counts vs stress, sum of counts vs events and log-sum amplitude distribution; are developed on uncracked tensile specimens to characterize the sources of acoustic emission in a precipitation hardened aluminum alloy. The measurements are extended to specimens containing nonpropagating through thickness cracks, which detect the crack and evaluate its proximity to fracture. These findings are based on the sources that generate acoustic emission ahead of the crack's leading edge: dislocations breaking away from precipitate pinning points in multitudes and subsequent cracking of precipitate particles. A mathematical model is developed for a non-propagating through thickness crack, where the dislocation generated emissions are a function of applied stress, with crack length contained as an unknown quantity. The analysis is based on experimental results, atomic dislocation mechanism, and physical response of the measurement. The analysis characterizes the source in terms of: atomic dislocation variables that account for the energy required for one dislocation to surmount its precipitate barriers, and number of dislocations that evolve this energy when the source is activated by the flow stress. Dissert. Abstr.

N86-23968 Georgia Inst. of Tech., Atlanta.
EFFECT OF DELAMINATION ON AXIALLY-LOADED PLATE- AND SHELL-LIKE ELEMENTS Ph.D. Thesis
Sayed Nageb Sallam 1985 161 p
Avail: Univ. Microfilms Order No. DA8528639

The delamination of both flat (plates) and curved (cylindrical shells) structural elements is investigated. For flat elements, a simple one dimensional model is developed to predict delamination buckling loads of an across the width delamination in an axially loaded plate. The model is employed to predict critical loads for both simply supported and clamped boundary conditions. Parametric studies are carried out to investigate the effects of delamination position and size on the critical loads. Moreover, the delamination growth problem is also investigated. In order to study the possibility of spreading of the damaged (delaminated) area to the undamaged one, the postbuckling solution is employed. The energy release rate is used to determine whether the delamination growth is stable or unstable. Moreover, the present model is used to study the effect of the presence of coupling between bending and stretching on the delamination growth. Finally, the effect of circumferential delamination on the critical loads, for a laminated circular cylindrical shell and subjected to compressive axial loading, is also studied. Dissert. Abstr.

N86-23969 Iowa Univ., Iowa City.
FATIGUE AND DEFORMATION UNDER PROPORTIONAL AND NONPROPORTIONAL BIAXIAL LOADING Ph.D. Thesis
Ali Fatemi 1985 210 p
Avail: Univ. Microfilms Order No. DA8527968

Fatigue and deformation behavior of thin-walled tubular specimens subjected to biaxial in-phase and out-of-phase tension-torsion constant amplitude loading in strain control and at room temperature was investigated using 1045 HR steel. The in-phase data were already available from a previous study conducted at the University of Illinois. The out-of-phase tension-torsion tests were performed with a 90 degree phase difference along both elliptical and rectangular train paths. Several fatigue life prediction methods were employed to correlate the experimental results including Tresca, von Mises, Zamrik's total strain parameter, Brown and Miller's critical plane approach and a proposed critical plane model. The proposed model is based on the maximum shear strain amplitude and either the maximum principal stress or the normal stress on the plane of maximum shear strain amplitude depending upon the cracking mode. The cyclic deformation behavior of the material under proportional and nonproportional loads was also investigated employing both the Tresca and von Mises yield criteria. Dissert. Abstr.

N86-23970 New York Univ., New York.
FORCED MOTION OF INITIALLY STRESSED ELASTIC SOLIDS: ANALYTICAL AND FINITE ELEMENT METHODS Ph.D. Thesis
Young Doo Kwon 1985 206 p
Avail: Univ. Microfilms Order No. DA8528269

The present thesis develops a finite element procedure to calculate displacements, strains and stresses in three-dimensional, initially stressed solids subjected to static or time-dependent loading conditions. As a point of departure, Hamiltonn's principle is employed to obtain a system of (linear) algebraic equations of motion (or equilibrium) characterizing the displacements in a solid which, for the sale of approximation, has been subdivided into a large number of finite elements. In the static case (i.e., time-independent loading function) inertia terms in the equations of motion are deleted. In this case the Gauss elimination method is used to solve the resulting equations for the displacement field. When the loading function is dependent upon time, the equations of motion must be integrated with respect to time. Newmark's direct integration method is readily applied to this problem to obtain the displacements as a function of time. An alternative method for the solution of the time-dependent problem is provided by mode superposition method. Dissert. Abstr.

N86-23971 Cincinnati Univ., Ohio.
INVESTIGATION OF MULTIPLE INPUT FREQUENCY RESPONSE FUNCTION ESTIMATION TECHNIQUES FOR EXPERIMENTAL MODAL ANALYSIS Ph.D. Thesis
Robert William Rost 1985 237 p
Avail: Univ. Microfilms Order No. DA8526568

The accurate measurement of the frequency response function is vital to the estimation of the modal parameters of a system. The use of single input/output theory to formulate the equations for the frequency response function can be replaced by an equivalent theory involving multiple inputs. The results of this approach provide frequency response functions that are comparable to the single input/output case but with an increase in the consistency of modal frequency and damping values estimated from different frequency response functions. The concept of MAC, Modal Assurance Criterion, was expanded to include the possibility

of multiple reference data. Numerous tests were conducted to evaluate and prove the techniques presented. The structures range from machine tools, airplanes, automobiles, electric generators, and encompass almost any large structure imaginable.
Dissert. Abstr.

N86-23972 Texas Univ., Austin.
DEVELOPMENT AND APPLICATION OF A THEORY OF FINITE ELASTOPLASTICITY BASED ON GENERALIZED POTENTIALS Ph.D. Thesis
Seung Jo Kim 1985 167 p
Avail: Univ. Microfilms Order No. DA8527588

A theory of materials of type N is proposed as thermomechanically plausible theory of finite elastoplasticity along with a new definition of a strain measure for large deformations. The theory requires two scalar-valued potential representations (the free energy and the flow potential) in addition to the field equations. By applying the concept of Clarke-Rockafellar derivatives, it is possible to consider potentials which are neither convex nor differentiable. The thermodynamic constraints of the theory produce in a natural way a rotation-free stress quantity, which is called Dieness stress, as a dual variable to the proposed rotation-free strain rate. General forms of the free energy and the flow potential are provided and it is shown that some of the classical theories of plasticity can be obtained from these two potentials as special cases. A set of constitutive equations is deduced from Bodner and Partom's constitutive equations according to the theory of materials of type N, which provide a thermomechanically sound theory. Dissert. Abstr.

N86-23973*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
HEX BALL TORQUE TEST
B. A. Robinson and C. L. Foster Jan. 1986 110 p refs
(NASA-TM-86534; NAS 1.15:86534) Avail: NTIS HC A06/MF A01 CSCL 20K

A series of torque tests were performed on four flight-type hex ball universal joints in order to characterize and determine the actual load-carrying capability of this device. The universal joint is a part of manual actuation rods for scientific instruments within the Hubble Space Telescope. It was found that the hex ball will bind slightly during the initial load application. This binding did not affect the function of the universal joint, and the units would wear-in after a few additional loading cycles. The torsional yield load was approximately 50 ft-lb, and was consistent among the four test specimens. Also, the torque required to cause complete failure exceeded 80 ft-lb. It is concluded that the hex ball universal joint is suitable for its intended applications. Author

N86-23974*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
POCKETING MECHANICS OF SRM NOZZLE LINER
Vincent S. Verderaime 1986 27 p refs
(NASA-TP-2577; NAS 1.60:2577) Avail: NTIS HC A03/MF A01 CSCL 20K

A systems approach was adopted to study the pocketing phenomena on a solid rocket nozzle liner. The classical thermoelastic analysis was used to identify marginally strained regions on the composite liner erosion surface and at a depth coincident with the peak value of the across ply coefficient of thermal expansion. A failure criterion was introduced which included a thermal term and permitted failure assessment over the charred liner. The method was verified by satisfactory application to a reported related experiment. Liner pocketing mechanism was attributed to very localized material degradation caused during manufacturing process either by reduction of fiber strength and/or by concentration of resin volume fraction. Pocketing scenario over the degraged material was constructed with supporting formulation to predict size of fissures with respect to degraded material size and location in the liner and with burn time. Sensitivities of liner material parameters were determined to influence test programs designed to update mechanical data base of carbon cloth phenolic over the char temperature range. Author

N86-23975*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DESIGN AND VERIFICATION GUIDELINES FOR VIBROACOUSTIC AND TRANSIENT ENVIRONMENTS
Mar. 1986 27 p refs
(NASA-TM-86538; NAS 1.15:86538) Avail: NTIS HC A03/MF A01 CSCL 20K

Design and verification guidelines for vibroacoustic and transient environments contain many basic methods that are common throughout the aerospace industry. However, there are some significant differences in methodology between NASA/MSFC and others - both government agencies and contractors. The purpose of this document is to provide the general guidelines used by the Component Analysis Branch, ED23, at MSFC, for the application of the vibroacoustic and transient technology to all launch vehicle and payload components and payload components and experiments managed by NASA/MSFC. This document is intended as a tool to be utilized by the MSFC program management and their contractors as a guide for the design and verification of flight hardware. Author

N86-23976# Toronto Univ., Downsview (Ontario). Inst. for Aerospace Studies.
ON THE ANALYSIS OF SHELL STRUCTURES SUBJECTED TO A BLAST ENVIRONMENT: A FINITE ELEMENT APPROACH, PART 1
Glenn R. Heppler Feb. 1986 210 p refs
(UTIAS-302-Pt-1; ISSN-0082-5255) Avail: NTIS HC A10/MF A01

The development of a finite element technique designed specifically for the analysis of blast loaded (chemical explosions) or combined blast and thermally loaded (nuclear explosions) circular cylinders is outlined. Following a brief introduction the formulation of the stiffness matrix is presented which includes discussions of the material and geometric nonlinearities included in the finite element model. The consistent force vector calculation is illustrated, including techniques used to deal with thermal loading and blast wave loading. Subsequently examples and results are presented which verify the accuracy and versatility of the static formulation of the problem. Author

N86-23977# Toronto Univ., Downsview (Ontario). Inst. for Aerospace Studies.
ON THE ANALYSIS OF SHELL STRUCTURES SUBJECTED TO A BLAST ENVIRONMENT: A FINITE ELEMENT APPROACH, PART 2
Glenn R. Heppler Feb. 1986 231 p refs
(UTIAS-302-Pt-2; ISSN-0082-5255) Avail: NTIS HC A11/MF A01

The development of a finite element technique designed specifically for the analysis of blast loaded (chemical explosions) or combined blast and thermally loaded (nuclear explosions) circular cylinders is outlined. To lead into the dynamic analysis the consistent mass matrix development is presented along with that for a companion diagonal mass matrix which exhibits dynamically correct behavior. The requirements of temporal integration schemes are investigated and the necessary and sufficient conditions for a liner single step integration method to be stable when operating on a system of motion equations in which the damping matrix is nonproportional are presented. Finally, examples of dynamic analyses, including a cylinder loaded by a nuclear burst, using the methods outlined herein are presented. Author

N86-23978# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
AN APPROACH FOR ORDER REDUCTION AND PLACEMENT OF ACTUATORS/SENSORS FOR THE CONTROL OF A CLASS OF DISTRIBUTED PARAMETERS SYSTEMS
Paulo Tadeu M. Lourencao Feb. 1986 9 p refs Presented at TELECON 85, Rio de Janeiro, Brazil, 10-13 Dec.
(INPE-3791-PRE/886) Avail: NTIS HC A02/MF A01

Aspects of the dynamics and control of a class of distributed parameter system are considered. The vibrating structures

techniques for order reduction are discussed and compared taking into account their applicability to the control of those structures. Two structures, a free-free beam and a completely free rectangular plate are considered to investigate the influence of the number, position and type of actuators and sensors on the reduced model. Mode dominance distributions are presented for both structures corresponding to different configurations of actuators/sensors. It is shown that the dominance measure originally proposed for the selection of critical modes can be also used to specify convenient actuators/sensors arrangements. E.A.K.

N86-23979# Aeronautical Research Labs., Melbourne (Australia).
A NUMERICAL INVESTIGATION INTO THE PLASTIC STRESS AND STRAIN FIELDS AROUND A SURFACE CRACK
R. J. M. Heller and J. T. Barnby Jan. 1985 22 p
(AD-A161937; ARL-STRUC-414) Avail: NTIS HC A02/MF A01 CSCL 20/11

Two finite element approaches for the three dimensional elastic-plastic analysis of a surface crack are presented. The distributions of the stress and strain fields around the crack are discussed in detail and it is shown that both approaches yield similar values for the strain energy distribution around the crack. Author (GRA)

N86-23980# Cambridge Univ. (England).
DEFORMATION AND FRACTURE MAPS FOR CELLULAR MATERIALS AND SOLID POLYMERS Final Technical Report, 18 Sep. 1984 - 10 Sep. 1985
Michael F. Ashby, Peter W. R. Beaumont, L. J. Gibson, D. G. Gilbert, and S. K. Maiti 31 Oct. 1985 44 p
(Contract DAJA45-84-M-0426; DA Proj. 1L1-61102-BH-57)
(AD-A161947; CUED/C/MAPS/TR118) Avail: NTIS HC A03/MF A01 CSCL 11/9

The mechanical properties of 3 types of cellular solids (flexible, plastic and brittle) have been measured as a function of density. The results are compared with models for the stiffness, strength and densification; and constitutive laws are developed. Data and models for each type of cellular solid are combined to develop mechanism-mode maps which summarize the properties in a single diagram. Natural cellular materials fit the same pattern; maps are presented, as an example, for wood. The maps help in design and in the selection of materials for load-bearing and energy-absorbing applications. GRA

N86-23981# Southwest Research Inst., San Antonio, Tex.
NONLINEAR FRACTURE MECHANICS ANALYSIS WITH THE BOUNDARY INTEGRAL METHOD Annual Technical Report, 2 Apr. 1984 - 29 Mar. 1985
T. A. Cruse and E. Z. Polch 30 Apr. 1985 36 p
(Contract F49620-84-C-0042)
(AD-A162027; AFOSR-85-1072TR) Avail: NTIS HC A03/MF A01 CSCL 20/11

The current research makes use of the boundary integral equation (BIE) method, as modified to account exactly for the elastic crack problem. The usual BIE formulation for elastic problems reduces the numerical problem to one of modeling the boundary data, while preserving the complete interior solution of the field equations. In the elastic fracture mechanics problem, the Green's function approach is used wherein the BIE is modified to account for the presence of a stress free crack at an arbitrary location within the structure. The use of the Green's function for the crack eliminates the need to model the boundary of the crack, and provides a complete mathematical description of the elastic strain field within the body, due to the crack. This clearly contrasts with the finite element method which requires that the crack surface and the interior strains be modeled with some set of interpolation functions. However, extension of the fracture mechanics model with the Green's function approach has not been previously demonstrated. The current work reports on the successful extension of the special Green's function formulation for the fracture mechanics problem to the elastoplasticity formulation. Author (GRA)

N86-23982# Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.
MIXED MODE 1 AND 2 FULLY PLASTIC CRACK GROWTH FROM SIMULATED WELD DEFECTS Technical Report
George A. Kardomateas 23 Oct. 1985 210 p
(Contract N00014-82-K-0025)
(AD-A162108) Avail: NTIS HC A10/MF A01 CSCL 13/8

In symmetric specimens, the crack advances into the relatively undamaged region between two plastic shear zones. A crack near a weld or shoulder, loaded into the plastic range, may have only a single shear band, along which the crack grows in prestrained and damaged material with less ductility than the usual symmetrical configurations. A crack ductility can be defined as the minimum displacement per unit crack growth. A low crack ductility requires higher stiffness of the surrounding structure for fracture-stable design. Tests of six alloys showed that, for the low hardening alloys, the crack ductility in the asymmetric case is less than a third of the symmetric. In the higher hardening alloys the crack ductility in the asymmetric case is smaller by a factor of 1.2 at most. A noteworthy result is the presence of a Mode 1 opening component even with asymmetry, as is shown by the far field displacement vector being more than 45 deg from the transverse direction. The crack direction is less than 45 deg, indicating the effect of triaxiality on cracking. Finally, a logarithmic tensile singularity in the mean stress was found for rigid-plastic flow past a growing crack of finite angle with rigid flanks under combined shear and tension. The tensile singularity predicts yielding of the crack flanks. GRA

N86-23983# Cornell Univ., Ithaca, N.Y.
THE RELIABILITY OF LOAD SHARING SYSTEMS Final Technical Report, 1 Jun. 1984 - 31 May 1985
Howard M. Taylor Nov. 1985 6 p
(Grant AF-AFOSR-0165-84)
(AD-A162121; AFOSR-85-1096TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

In a load sharing system, the failure of one or more components increases the load on other nonfailed components, thereby increasing their chances of failure, and the failure of the system. Examples of load sharing systems include many mechanical, thermal and electrical structures. System reliability is measured by the probability that the system is capable of performing its prescribed task or surviving for a prescribed duration. Traditional reliability models often postulate that component failures are statistically independent and, thus, do not describe load sharing systems. The optimal replacement theory for fault tolerant load sharing systems was developed under the support of the grant. As components fail, the system deteriorates. Where failed components cannot be replaced individually, and algorithm was found that determines the optimal policy for replacing the entire system. GRA

N86-23984# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
NONDESTRUCTIVE TESTING OF MATERIALS Final Report
5 Dec. 1985 19 p
(AD-A162266; TOP-3-2-807) Avail: NTIS HC A02/MF A01 CSCL 14/2

Standard techniques and facilities for evaluating surface and subsurface characteristics of metallic/nonmetallic materials are described. It identifies current nondestructive test methods and ultrasonic test techniques applicable to cannon tubes, cast armor plate, welded joints, projectile fuzes, vehicle track shoes, and other items in which detection of cracks, voids, corrosion, and thickness variations is important. GRA

N86-23985# Defence Research Establishment, Ottawa. (Ontario).
EXAMINATION OF THE LOAD-ELONGATION PROPERTIES OF FABRICS, YARNS AND FIBRES AT 20 AND 40 C
Rita M. Crow and Malcolm M. Dewar Jun. 1985 36 p
(AD-A162324; DREO-923) Avail: NTIS HC A03/MF A01 CSCL 11/5

A previous study by the authors on the effect of low tempera-

tures on coated and uncoated fabrics raised certain points which were left unanswered. This study addresses these points. It was found that the load-elongation curve of the fabric is not necessarily the same as that of a yarn or a filament; differences in the percent elongation at break of a fabric and its yarn depend on the physical properties of the yarn; inconsistent differences in the percent change in the percent elongation at break for warps and wefts of the same fabric as the temperature is decreased is procedure-dependent and it is the fabric, yarn and filament working in concert which give each fabric its unique load-elongation curve. GRA

N86-23986# Georgia Inst. of Tech., Atlanta. School of Engineering Science and Mechanics.

BUCKLING OF DELAMINATED SHELLS AND MULTI-ANNULAR PLATES Final Report, 1 Sep. 1984 - 31 Aug. 1985

George J. Simitses, Sayed Nageb Sallam, and Yeoshua Frostig Oct. 1985 159 p

(Grant AF-AFOSR-0243-83)

(AD-A162371; AFOSR-85-1081TR) Avail: NTIS HC A08/MF A01 CSCL 20/11

Buckling of delaminated thin cylindrical shells is investigated. The thin cylinders are axially-loaded and their geometry is virtually isotropic. The effects of boundary conditions, delamination size, and delamination position on the buckling load are studied. Buckling analysis of multi-annular plastes is also presented. The annular sections are made of different materials, their size is varied, and the composite circular plates are supported in various ways. The rigidities of the various parts are varied in order to cover the cases of plates with holes, with rigid inclusion, and ring stiffeners. GRA

N86-23987# Akron Univ., Ohio. Inst. of Polymer Science.

COMPRESSION OF RUBBER LAYERS BONDED BETWEEN TWO PARALLEL RIGID CYLINDERS OR BETWEEN TWO RIGID SPHERES

A. N. Gent and Byoungkyeu Park Dec. 1985 27 p

(Contract N00014-85-K-0222)

(AD-A162902; TR-1) Avail: NTIS HC A03/MF A01 CSCL 11/10

The stiffness of bonded rubber blocks under small compressive deformations has been studied extensively. A recent review deals with the problem in connection with the use of elastomeric laminaes as bridge bearings. However, previous studies have been mainly concerned with a flat rubber block bonded between two flat rigid plates. An approximate treatment is given here for the stiffness of a rubber layer bonded between two opposed curved rigid surfaces, cylindrical or spherical in shape. The predictions of the theoretical treatment are then compared with measured values of compressive stiffness for various initial separations (and hence rubber layer thicknesses) of the two rigid surfaces, relative to their diameter. GRA

N86-23988# Illinois Univ., Urbana.

NONLINEAR EARTHQUAKE ANALYSIS OF CONCRETE BUILDING STRUCTURES Final Report

Daniel P. Abrams Sep. 1985 80 p

(Contract N00014-83-D-0689)

(AD-A162967) Avail: NTIS HC A05/MF A01 CSCL 13/13

Proportioning of strength in an earthquake resistant structure is usually based on a linear elastic analysis and a set of equivalent static lateral forces. This design procedure has proven to be reliable on the basis of observed building damage caused by past earthquakes and has been adopted by present building codes. Presently, inelastic design of concrete structures subjected to load reversals is an art much like design of continuous structures subjected to gravity loadings was in the earlier part of the century. Inelastic stiffness characteristics of concrete components have been shown through experiments to be influenced by parameters not previously considered for analysis of structures subjected to montonically increasing forces. Hysteretic behavior of members and connections have been shown to be dependent on opening and closure of flexural and shear cracks, bond-slip mechanisms, softening of reinforcement, and inelasticity of concrete in compression. Because of the complexity of inelastic behavior and the uncertain sequence of ground excitations, several analyses need to be done so that an engineer may develop the judgement needed to implement a particular design. A simple tool needs to be developed for these analyses. The purpose of study described in this report is to develop an analytical technique that considers explicitly both the history of the ground motion, and the nonlinear hysteretic behavior of the structure. The technique is developed using nonlinear resistance characteristics of reinforced concrete structures, however, the basis of the method is applicable to any type of building structure. GRA

N86-23989# California Univ., Berkeley. Lawrence Berkeley Lab.

COMPARISON OF FATIGUE CRACK PROPAGATION IN MODES 1 AND 3

R. O. Ritchie Jun. 1985 47 p Presented at the 18th American Society for Testing and Materials Symposium, Boulder, Colo., 1 Jun. 1985

(Contract DE-AC03-76SF-00098)

(DE86-002877; LBL-19828; CONF-850679-3) Avail: NTIS HC A03/MF A01

The propagation behavior of fatigue cracks in Mode 3 (anti-plane shear), measured under cyclic torsion, is described and compared with more commonly encountered behavior under Mode 1 (tensile opening) loads. It is shown that a unique, global characterization of Mode 3 growth rates, akin to the Paris law in Mode 1, is only possible if characterizating parameters appropriate to large-scale yielding are employed and allowance is made for crack tip shielding from sliding crack surface interference (i.e., friction and abrasion) between mating fracture surfaces. Based on the crack tip stress and deformation fields for Mode 3 stationary cracks, the cyclic crack tip displacement, (DELTA)CTD/sub III/, and plastic strain intensity range (DELTA)GAMMA/sub III/, have been proposed and are found to provide an adequate description of behavior in a range of steels, provided crack surface interference is minimized. The magnitude of this interference, which is somewhat analogous to crack closure in Mode 1, is further examined in the light of the complex fractography of torsional fatigue failures and the question of a fatigue threshold for Mode 3 crack growth. Finally, micro-mechanical models for cyclic crack extension in anti-plane shear are briefly described, and the contrasting behavior between Mode 3 and Mode 1 cracks subjected to simple variable amplitude spectra is examined in terms of the differing role of crack tip blunting and closure in influencing shear, as opposed to tensile opening, modes of crack growth. DOE

N86-23990# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Reaktorwerkstoffe.

CALCULATION OF CREEP DEFORMATIONS UNDER RIGOROUS APPLICATION OF THE CONTINUUM-MECHANICAL EQUILIBRIUM CONDITIONS

H. Cords, G. Kleist, and R. Zimmermann Jul. 1985 82 p refs In GERMAN; ENGLISH summary Original contains color illustrations

(JUEL-Spez-321; ISSN-0343-7639) Avail: NTIS HC A05/MF A01

Deformation characteristics and stress changes under the application of rigorous equilibrium conditions were calculated. It is shown that the instability problems of finite element creep calculations are caused by residual restraining. A numerical method to impose creep strains without restraints is examined. The two methods were used to calculate stress relaxation in a thick-walled tube under thermal load and internal as well as external pressure. The results for stress relaxation, which in the case of unrestraining creep strains is treated as an independent relaxation process, are different for the two methods. Creep properties of a circumferentially notched bolt under uniform tension were investigated. The calculations show that in the state of stationary creep the minimum cross section retains its diameter. Experimental results confirm this property for the initial change of the specimen shape. However, a long term extrapolation on a steady state creep

basis underestimates the creep deformations at the notch.
Author (ESA)

N86-23991# Ministerie van Onderwijs en Wetenschappen, s'Gravenhage (Netherlands). Technische Wetenschappelijke Dienst.
INVESTIGATION OF THE NATURE AND IMPORTANCE OF CRACK FORMATION IN A CREEP-LOADED T-SHAPED COMPONENT 4 NIL-RLD [ONDERZOEK NAAR AARD EN OMVANG VAN SCHEURVORMING IN EEN KRUIP BELAST T-STUK (KOMPONENT 4 NIL-RLD PROG.)]
M. Kornalijnslijper and R. Bambach 1 Aug. 1985 17 p In DUTCH
(TWD-87815) Avail: NTIS HC A02/MF A01

The nature and importance of crack formation in a T-shaped component were investigated. The crack occurs in the cheek of the T-shaped component at the bottom of the weld in the heat-affected zone and covers 20% of the circumference (65 mm). The maximum depth is 1.5 to 2 mm, i.e., 15% of cheek thickness. The origin of this very localized damage is found to be creep. The cumulation of factors such as dimensioning, geometry, and the heat treatment accelerate the crack initation and propagation.
Author (ESA)

N86-24523*# John Brown Univ., Siloam Springs, Ark. Dept. of Mechanical Engineering.
A PHOENICS MODEL FOR THE TRIAXIAL LOADING OF AN INITIALLY CYLINDRICAL MASS OF RATE-TYPE MATERIAL WITH PROVISIONS FOR BULGING AND YIELD
kenneth W. French, Jr. *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 20 p refs (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 20K

42 GEOSCIENCES (GENERAL)

No abstracts in this category.

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography.*

N86-23992 Deutsche Geodaetische Kommission, Munich (West Germany).
RECTIFICATION OF SCANNER IMAGES USING PREDICTION APPROACHES Ph.D. Thesis - Bonn Univ. [ENTZERRUNG VON SCANNERBILDERN MIT PRAEDIKTIONSANSAETZEN]
Andreas Rose Bayerischen Akademie der Wiessenschaften 1984 85 p refs In GERMAN
(SER-C-303; ISBN-3-7696-9353-1; ISSN-0065-5325) Copyright. Avail: Issuing Activity

The rectification of airborne scanner data was investigated. The concept on which the covariance estimation is based, and the resulting prediction formulas are explained; the common ground and differences with the Ebner method are discussed. The developed method was tested on airborne scanner images. The prediction of the image rectification results from the prediction of orientation parameters; the model combines interpolation and parametric methods. A modular programming system was developed to conduct the rectification work; the programming package consists of a prediction and an image processing part. The test results satisfy expectations; a substantial increase in accuracy is obtained. The improvements depend on the number and the quality of the control points.
Author (ESA)

N86-23993# National Oceanic and Atmospheric Administration, Washington, D. C. National Environmental Satellite, Data, and Information Service.
HYDROLOGIC AND LAND SCIENCES APPLICATIONS OF NOAA POLAR-ORBITING SATELLITE DATA
Michael Matson and Frances Parmenter-Holt [1985] 24 p refs Original document contains color illustrations
Avail: NTIS HC A02/MF A01

Hydrologic and land sciences applications of NOAA polar orbiting satellites presented include: continental snow cover; river basin snow mapping and flood monitoring; soil moisture analysis; vegetation progress and seasonal changes; fire detection and monitoring; urban effects; volcanoes; and geologic assessment.
B.G.

N86-23994*# Delaware Univ., Newark. Coll. of Marine Studies.
REMOTE SENSING INVESTIGATIONS OF WETLAND BIOMASS AND PRODUCTIVITY FOR GLOBAL BIOSYSTEMS RESEARCH Final Technical Report, 1 Nov. 1982 - 1 Apr. 1986
V. Klemas 15 Apr. 1986 25 p refs
(Grant NAGw-374)
(NASA-CR-176725; NAS 1.26:176725) Avail: NTIS HC A02/MF A01 CSCL 08B

The relationship between spectral radiance and plant canopy biomass was studied in wetlands. Spectroradiometer data was gathered on Thematic Mapper wavebands 3, 4, and 5, and correlated with canopy and edaphic factors determined by harvesting. The relationship between spectral radiance and plant canopy biomass for major salt and brackish canopy types was determined. Algorithms were developed for biomass measurement in mangrove swamps. The influence of latitudinal variability in canopy structure on biomass assessment of selected plants was investigated. Brackish marsh biomass estimates were obtained from low altitude aircraft and compared with ground measurements. Annual net aerial primary productivity estimates computed from spectral radiance data were compiled for a Spartina alterniflora marsh. Spectral radiance data were expressed as vegetation or infrared index values. Biomass estimates computed from models were in close agreement with biomass estimates determined from harvests.
Author

N86-23995*# Operations Research, Inc., Landover, Md.
EOS RADIOMETER CONCEPTS FOR SOIL MOISTURE REMOTE SENSING Final Report
Jim Carr 10 Feb. 1986 175 p
(Contract NAS5-28648)
(NASA-CR-177854; NAS 1.26:177854) Avail: NTIS HC A08/MF A01 CSCL 08B

Preliminary work with aperture synthesis concepts for EOS is reported. The effects of nonvanishing bandwidths on image reconstruction in aperture synthesis system was studied. It is found that nonvanishing bandwidths introduce errors in off-axis pixels when naive Fourier processing is used. The net effect is for bandwidth to limit sensor field-of-view. To quantify this effect a computer program was written which is documented. Example runs are included which illustrate the resultant radiometric errors and effective fields-of-view for a plausible simple sensor.
Author

N86-23996# Hydrospace Research Corp., Rockville, Md. Physical Acoustics Div.
THREE-DIMENSIONAL ELASTO-PLASTIC ANALYSIS FOR SOILS Annual Report, 15 Jun. - 14 Aug. 1985
George E. Blandford and Bobby O. Hardin 26 Sep. 1985 170 p
(Grant AF-AFOSR-0195-84)
(AD-A162063; AFOSR-85-1090TR) Avail: NTIS HC A08/MF A01 CSCL 08/13

This report presents the first year accomplishments perfecting the elastoplastic soil constitutive equations of Hardin (1978) and their implementation into Elasto-Plastic Soil Analysis Program (EPSAP). The elastoplastic soil constitutive equations reflect the

essential features of soil behavior that result from the soil skeleton being particulate. Constitutive equation modeling improvements include: (1) crushing of soil particles; (2) strength of soils in terms of effective stress; and (3) modification of the class 1 plastic potential function. The EPSAP is a three-dimensional finite element code which is being developed as part of the research. The developments for EPSAP include expressing the two classes of soil loading in matrix form and their subsequent finite element implementation. The EPSAP includes a three node line load element, six node triangular and eight node quadrilateral surface load elements, and fifteen node prism and twenty node hexahedron domain elements. A predictor-corrector solution algorithm for solving the nonlinear equation and the out-of-core nonsymmetric skyline solver are discussed. Results for a triaxial compression simulation are presented. GRA

N86-23997# Lockheed Missiles and Space Co., Palo Alto, Calif. Research and Development Div.

NUMERICAL GENERATION OF 3D CURVILINEAR COORDINATE SYSTEMS AND COMPUTATIONAL GRIDS FOR AIRCRAFT CONFIGURATIONS Final Technical Report, May 1982 - Jul. 1984

P. D. Thomas and A. K. Whitney Mar. 1985 22 p
(Contract F49620-82-C-0065)
(AD-A162249; LMSC/F035606; AFOSR-85-1058TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

This report describes the progress in research on the properties of the Lockheed 3-D elliptic grid generation procedure and improvement of its capabilities for treating complex geometric features characteristic of aircraft configurations. Two areas of weakness in the original technique relate to the fundamentally important capability for generating curved-surface grids as a necessary prerequisite for generating 3-D space grids. These weaknesses were: (1) difficulties associated with the limitations of Cartesian coordinates for describing convex surfaces; and problems in controlling the orthogonality of the grid near boundaries. The bulk of the first year's research resulted in development of a generalized system of elliptic grid generation equations that allow both the surface and the grid to be described in terms of an arbitrary system of curvilinear coordinates. Research in the second year was concerned primarily with the problem of grid orthogonality near boundaries. Three approaches investigated to improve the control that the user has over the angle at which grid lines intersect the boundaries were: (1) refinement of the original techniques; (2) development of techniques for marching from a given boundary using the angle as an initial condition; and (3) derivation of a fourth-order system that permits additional boundary conditions on the grid intersection angle. GRA

N86-23998# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Hydraulics Lab.

USERS MANUAL FOR THE GENERALIZED COMPUTER PROGRAM SYSTEM OPEN-CHANNEL FLOW AND SEDIMENTATION TABS-2: MAIN TEXT AND APPENDICES A THROUGH O Final Report

William A. Thomas and William H. McAnally, Jr. Aug. 1985 680 p
(AD-A162390; WES/IR/HL-85-1) Avail: NTIS HC A99/MF A02 CSCL 13/2

TABS-2 is a generalized numerical modeling system for open-channel flows, sedimentation, and constituent transport. It consists of more than 40 computer programs to perform modeling and related tasks. The major modeling components--RMA-2V, STUDH, and RMA-4--calculate two-dimensional, depth-averaged flows, sedimentation, and dispersive transport, respectively. The other programs in the system perform digitizing, mesh generation, data management, graphical display, output analysis, and model interfacing tasks. Utilities include file management and automatic generation of computer job control instructions. TABS-2 has been applied to a variety of waterways, including rivers, estuaries, bays, and marshes. It is designed for use by engineers and scientists who may not have a rigorous computer background. Use of the various components is described in Appendices A-O. GRA

N86-23999# Tulsa Univ., Okla.

STABILITY OF NATURAL GAS IN THE DEEP SUBSURFACE Final Report

C. Barker Jul. 1985 86 p refs
(Contract DE-FG05-84ER-13220)
(DE86-002177; DOE/ER-13220/T1) Avail: NTIS HC A05/MF A01

A computer program has been developed for calculating the stabilities of natural gas components in reservoirs of various mineralogies. It finds the minimum free energy in multi-component (up to 70), multiphase (up to 20) systems for conditions corresponding to temperatures and pressures down to 40,000 ft. (12 km) and does not assume ideal gas behavior. These calculations show that methane has considerable stability in sandstone reservoirs even in the presence of feldspars and their clay breakdown products. However, if there is appreciable calcite cement, this tends to thermally decompose at high temperatures and the evolved carbon dioxide then dilutes the methane to give overall gas compositions that are unlikely to be economic. In carbonate systems the main factor influencing methane stability is the presence of sulfur-bearing phases such as anhydrite. The sulfur compounds lead to hydrogen sulfide production and methane is eliminated so that at 40,000 feet the predicted gas composition is CO2-H2S. A computer-controlled, fast-scanning mass spectrometer system has been developed to analyze individual fluid inclusions in deep cements because these contain uncontaminated gas samples from the growth environment. Fluid inclusions are opened in vacuum by thermally-induced decrepitation and the computer program recognizes the abrupt rise in partial pressures for any, or all, of six selected components. The mass spectrometer scans from mass 1 to 65 every 25 msec (which is within the time constraints of a bursting inclusion) and determines each peak height. Fluid inclusions have been analyzed successfully in quartz, calcite, feldspars, galena and other minerals. Calcite cements from the deep Smackover Formation of the Gulf Coast (approx.20,000 feet) show methane-carbon dioxide-hydrogen sulfide compositions that are within the range calculated theoretically. DOE

N86-24000# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Hochfrequenztechnik.

SATELLITE-BORNE 90 GHz RADIOMETER EXPERIMENT (SABREX), PHASE A1

D. Salzer, H. Kietzmann, P. Sliwinski, B. Aumiller, H. Bloetscher, and R. Schmid Jun. 1985 174 p refs
(DFVLR-Mitt-85-13; ISSN-0176-7739) Avail: NTIS HC A08/MF A01; DFVLR, Cologne DM 51

Flight configurations for a 90 GHz satellite radiometer on a Stretched ROHINI Satellite bus are discussed. The satellite can be flown with its longitudinal symmetry axis in nadir direction (configuration 1) and with its longitudinal symmetry axis in direction of the velocity vector (configuration 2). Configuration 2 has a longer feeding system, lower overall noise due to lower feed system sidelobes, and better scanning possibilities. The main scientific objective of this experiment is the analysis of the capabilities of a 90 GHz satellite radiometer to determine the fluid water content of clouds, to measure low rain rates, to map the cloud cover and extended targets (diameter $>$ 1 km) and to map snow cover. Instrument design, radiometer calibration, data processing, ground support, and development schedule are considered. Author (ESA)

N86-24001# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Hauptabt. Verkehrsforschung.

A TRAVEL DEMAND MODEL BASED ON STATE VARIABLES OF GROUPS OF PERSONS HAVING AN EQUAL SOCIO-ECONOMIC STRUCTURE

Normann Treinies Jan. 1985 83 p refs In GERMAN; ENGLISH summary
(DFVLR-FB-85-51; ISSN-0171-1342) Avail: NTIS HC A05/MF A01; DFVLR, Cologne DM 26

A model to describe long distance travel activities, using a trip-type variable was derived. This variable is a combination of

travel mode and distance. The individuals are allocated to groups of equal household structure and travel accessibility constraints. Each group has distinct distributions of trip types. The distributions can be interpreted as variables of state of the groups. For such groups an entropy close to a theoretical maximum can be calculated. This can be interpreted as a condition of equilibrium and therefore the observed state of the groups can be expected to be stable if the constraints do not change. Author (ESA)

N86-24002# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Abt. Hochfrequenzverfahren.

ARCHIMEDES PROJECT REMOTE SENSING OF OIL SPILLS NORTH SEA EXPERIMENT, OCTOBER 1983. REPORT ON DFVLR (SIDE-LOOKING AIRBORNE RADAR (SLAR) CONTRIBUTION

Franz Witte Sep. 1985 30 p
(DFVLR-FB-85-54; ISSN-0171-1342) Avail: NTIS HC A03/MF A01; DFVLR, Cologne DM 13

Oil pollution monitoring by SLAR was assessed in flight tests using specially created slicks. The SLAR-system demonstrates its ability to detect and image oil slicks even on a smooth water surface. The received radar backscatter as a function of surface roughness and angle of incidence fluctuates considerably, so the probability to detect oil slicks increases by using steeper depression angles than normal to obtain a large swath width. An important tool to improve the accuracy of classification is the data correction algorithm. The classification quality strongly depends on viewing direction (best perpendicular to the waves) and on the sea state. As expected VV-polarization is the preferable solution for oil slick monitoring with a SLAR. Author (ESA)

N86-24003# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Systems Space Group.

MOMS-01 (MODULAR OPTOELECTRONIC MULTISPECTRAL SCANNER) FOR EARTH OBSERVATION: FIRST RESULTS OF STS-7 MISSION

D. Meissner, H. Laucht, J. Bodechtel, and R. Haydn 1985 15 p refs Presented at 1983 Joint International Geoscience and Remote Sensing Symposium (IGARSS 83) and National Radio Science-Commission F Meeting, FA-4, San Francisco, Calif., 31 Aug. - 2 Sep. 1983 Previously announced in IAA as A85-35050 Original contains color illustrations
Avail: NTIS HC A02/MF A01

The MOMS design is outlined and results from STS-7 are described. The mission included mapping of different ground targets with low to high contrast and albedo in visible and near infrared part of the spectrum over arid areas, areas with dense and sparse natural vegetation, coastal zones, mountainous regions and open ocean islands. System verification was achieved under space conditions for a 2-channel version to demonstrate the capability for scan line extension and the ability to combine pixel-coincident modules. Author (ESA)

N86-24004# Agricultural Research Service, Beltsville, Md.

NEAR INFRARED REFLECTANCE SPECTROSCOPY (NIRS): ANALYSIS OF FORAGE QUALITY

G. C. Marten, J. S. Shenk, and F. E. Barton Aug. 1985 97 p
(PB86-111523; AGRICULTURE/HB-643) Avail: NTIS HC A05/MF A01 CSCL 02A

Near infrared reflectance spectroscopy (NIRS) is a nonconsumptive, instrumental method for fast, accurate and precise evaluation of the chemical composition and associated feeding value attributes of forages and other feedstuffs provided the proper procedures are followed. Each of the major organic feed components has absorption characteristics in the near infrared region that are specific to the component. The absorption characteristics primarily determine diffuse reflectance, which gives the means to assess composition. The history of NIRS use for forage quality analysis is reviewed, available equipment and computer software, conventional and NIRS procedures for analysis of forage quality are summarized. GRA

N86-24005# DMEA Ltd., Scottsdale, Ariz.

EXPLORATION FOR STRATEGIC MATERIALS

B. F. Dickerson and C. A. OBrien 1985 210 p refs Sponsored by the Office of Technology Assessment
(PB86-126463) Avail: NTIS HC A10/MF A01 CSCL 08I

The report by the Office of Technology Assessment discusses technologies, methodologies, and the effects of technical and nontechnical factors on exploration for on-shore deposits of strategic materials. Author

N86-24006# Bureau of Mines, Juneau, Alaska. Field Operations Center.

ANALYSIS OF SAMPLING VARIANCE FROM CERTAIN PLATINUM AND PALLADIUM DEPOSITS IN ALASKA Report of Investigations, 1985

J. C. Barker, D. L. Thomas, and D. B. Hawkins 1985 34 p refs (PB86-108743; BM-RI-8948; LC-84-27421) Avail: NTIS HC A03/MF A01 CSCL 08I

The analytical variability encountered when sampling for platinum-group metals (PGM) was statistically evaluated. Sampling procedures were designed to systematically incorporate commonly used reconnaissance exploration techniques under actual field conditions. Analytical variability was evaluated at each procedural step. Analytical data from each sample from a single deposit grouped relatively well around the calculated mean for that deposit. GRA

N86-24547*# Alabama Univ., Birmingham. Dept. of Physics.

SOME ENERGY CONSIDERATIONS IN GAMMA RAY BURST LOCATION DETERMINATIONS BY AN ANISOTROPIC ARRAY OF DETECTORS

John H. Young *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 27 p refs (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 03B

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N86-24007*# Illinois Univ., Urbana-Champaign. Dept. of Electrical and Computer Engineering.

SUPERLATTICES AND NiPi STRUCTURES IN NEW FORMS OF CASCADE SOLAR CELLS Semiannual Report, 23 Oct. 1985 - 22 Apr. 1986

J. P. Leburton and K. Hess [1986] 11 p
(Grant NAG3-507)
(NASA-CR-176718; NAS 1.26:176718; SAR-4) Avail: NTIS HC A02/MF A01 CSCL 10A

The activity in the field of photovoltaic semiconductor superstructures is described. Progress was accomplished in the two principal directions previously defined in our initial proposal, i.e.: (1) Theoretical investigation of the optical properties of superlattices; and (2) New solar cell concepts and device modeling. Although important information concerning the optical constants of superlattices and multiple quantum well structures was obtained from our computer model, most of the theoretical efforts have progressively shifted from the former to the latter aspect of the project because of the discovery of a new kind of photovoltaic device which may exhibit improved performances with respect to conventional solar cells. Author

N86-24008*# Tennessee Univ. Space Inst., Tullahoma.
AN EXACT SOLUTION FOR THE SOLIDIFICATION OF A LIQUID SLAB OF BINARY MIXTURE Final Report, 2 Jan. 1985
B. N. Antar, F. G. Collins, and A. E. Aumalia Washington NASA Mar. 1986 77 p refs
(Contract NAS8-34268)
(NASA-CR-3962; NAS 1.26:3962) Avail: NTIS HC A05/MF A01 CSCL 11F

The time dependent temperature and concentration profiles of a one dimensional finite slab of a binary liquid alloy is investigated during solidification. The governing equations are reduced to a set of coupled, nonlinear initial value problems using the method outlined by Meyer. Two methods will be used to solve these equations. The first method uses a Runge-Kutta-Fehlberg integrator to solve the equations numerically. The second method comprises of finding closed form solutions of the equations. Author

N86-24009*# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
FUEL CELL ELECTROCATALYSIS Annual Report, 1985
P. N. Ross, Jr. Jan. 1986 15 p refs
(Contract DE-AC03-76SF-00098)
(NASA-CR-176746; NAS 1.26:176746; LBL-21038; UC-93-A) Avail: NTIS HC A02/MF A01 CSCL 10A

Commercialization of phosphoric acid fuel-cell technology requires a capital cost reduction and an extension of power section life compared to currently available technology. Significant capital cost reduction can be achieved if an oxygen-reduction catalyst which is catalytically more active than Pt supported on graphitized carbon black can be developed. The physical and chemical understanding of oxygen-platinum-ligand interaction necessary for the rational selection of alloying components were studied. Fundamental studies of the Pt alloy-electrolyte interface using modern surface science techniques should provide the means to optimize the alloy ligand or to redirect the search for more active materials along the most rational paths. Alloying may have significant beneficial effects on electrode performance above and beyond effects on the oxygen-reduction kinetics, (reduced Pt dissolution and surface-area loss). These additional alloying effects will also be studied at the atomic level, (surface reconstruction and surface self-diffusion). Author

N86-24010*# National Academy of Sciences - National Research Council, Washington, D. C.
SPACE STATION ENGINEERING AND TECHNOLOGY DEVELOPMENT. PROCEEDINGS OF THE PANEL ON SOLAR THERMODYNAMICS · RESEARCH AND TECHNOLOGY DEVELOPMENT, JULY 31, 1985
Oct. 1985 88 p Meeting held in Cleveland, Ohio, 31 Jul. 1985
(Contract NASw-4003)
(NASA-CR-176756; NAS 1.26:176756; PB86-140076) Avail: NTIS HC A05/MF A01 CSCL 10A

Solar thermodynamics research and technology is reported. Comments on current program activity and future plans with regard to satisfying potential space station electric power generation requirements are provided. The proceedings contain a brief synopsis of the presentations to the panel, including panel comments, and a summary of the panel's observations. Selected presentation material is appended. Onboard maintainability and repair in space research and technology plan, solar thermodynamic research, program performance, onboard U.S. ground based mission control, and technology development rad maps from 10 C to the growth station are addressed. GRA

N86-24011# GA Technologies, Inc., San Diego, Calif.
VARIABLE BAND GAP MATERIALS FOR THERMOPHOTOVOLTAIC GENERATORS Final Technical Report, 15 Aug. 1984 - 15 Aug. 1985
Lawrence D. Woolf, John C. Bass, and Norbert B Elsner Sep. 1985 132 p
(Contract F49620-84-C-0105)
(AD-A161987; GA-A18140; AFOSR-85-1069TR) Avail: NTIS HC A07/MF A01 CSCL 10/2

Thermophotovoltaic (TPV) properties of InGaAs cells with band gaps of either 1.15 or 1.2 eV, GaAs cells, and Si cells were investigated. In particular, dark and illuminated current vs voltage characteristics were obtained for a number of these concentrator cells at cell temperatures ranging from 300 to 550 K and currents varying from 10 to the minus 8th power to 10 A. Based on these data, the temperature dependence of the TPV efficiency for each of these cells was inferred for a fixed value of the parasitic absorption of the below-band-gap energy photons. For a given weighted parasitic absorption of 5%, the InGaAs cells have a significantly higher TPV efficiency than the GaAs or Si cells. TPV efficiencies approaching 40% at 300 K and 26% at 500 K appear feasible for the InGaAs cells. Based on these data, it was calculated that the specific mass of a space-based nuclear-TPV energy conversion system would be 10 kg/KW if InGaAs cells with 5% weighted parasitic absorption were used. In addition, a theoretical model was developed for determining the optimum efficiency of single and multiple band gap cells in TPV energy conversion.GRA

N86-24012# Minnesota Univ., Minneapolis. Dept. of Mechanical Engineering.
HIGH-TEMPERATURE SOLAR ENERGY RESEARCH AT THE UNIVERSITY OF MINNESOTA Technical Report, 1 Jul. 1984 - 31 Oct. 1985
Edward A. Fletcher 15 Nov. 1985 15 p
(Contract N00014-82-K-0523)
(AD-A162047; TR-7) Avail: NTIS HC A02/MF A01 CSCL 10/2

Solar energy, coming from a 5800K source, has thermodynamic value that is now becoming widely recognized for use in thermodynamic processes. For about ten years a small group at the Univ. of Minnesota has been conducting analytical and experimental studies which have the objective of using the sun's thermodynamic potential, both for chemical processing and for solar energy storage. This paper summarizes the published work, describes ongoing as yet unpublished work, and suggests future work. The emphasis is on both shorter and long range applications to industrial processes. GRA

N86-24013# Army Construction Engineering Research Lab., Champaign, Ill.
PHOTOVOLTAIC POWER SYSTEM PERFORMANCE: A CASE STUDY AT FORT HUACHUCA, ARIZONA Final Report
D. M. Joncich and R. A. Ducey Oct. 1985 24 p
(Contract MIPR-A1049)
(AD-A162248; CERL-TR-E-86/01) Avail: NTIS HC A02/MF A01 CSCL 10/2

A 5-kW-peak, grid-connected, photovoltaic (PV) power system is described. The PV system in service at the Holman Guest House, Fort Huachuca, Ariz., is evaluated for baseline data that will allow comparisons to be made with other PV systems. Designed and installed at a cost of $112,000, the system was funded by the Department of Energy's Federal Photovoltaic Utilization Program. Performance data gathered during 1983 by Arizona State University are summarized. The Holman Guest House power system provided nearly 8600 kWh of electricity during the test period, with no system failure and only minimal maintenance. This corresponds to approximately 11 percent of the facility's electrical requirement. If the system operates reliably for 20 years, the cost of photovoltaic energy would be roughly $0.50/kWh. Based on information gained from the demonstration project, the feasibility of future photovoltaic systems is discussed. GRA

N86-24014# National Bureau of Standards, Gaithersburg, Md. Ceramics Div.
SURVEY OF ALTERNATE STORED CHEMICAL ENERGY REACTIONS Annual Report, 25 May 1984 - 25 May 1985
L. P. Cook and E. R. Plante Dec. 1985 109 p
(Contracts N00014-83-F-0117; N00014-84-F-0204)
(AD-A163094; NBSIR-85-3282) Avail: NTIS HC A06/MF A01 CSCL 20/13

A survey of eight alternative liquid metal stored chemical energy reactions has been made for purposes of comparison with the lithium-aluminum/water, lithium/sulfur hexafluoride, and other

reaction schemes. The objective of this study was to survey the potential of these eight reactions as alternate stored chemical energy systems and to develop priorities for future study. Experimental data on the products of reaction and kinetics of reaction are presented for: Li/H2O; H2/O2, Li/H2O; NaO2/H2O; H2/O2, MgAl/H2O; H2/O2, and LiAl/ClO3F. These data have been collected using thermogravimetry and Knudsen effusion mass spectrometry, with X-ray diffraction analysis of experimental products. Among other results, the data show that the aluminum component of the fuels is relatively inert to oxidation up to 650 C. Above this temperature, materials limitations have hampered the collection of experimental data. Thermodynamic analysis has been used to extend the data on each of the eight reaction schemes, and to predict the chemical reaction which best represents the complete oxidation of each fuel by the indicated oxidant at 1100 K. Enthalpies have been calculated for each fuel/oxidant combination. Safety considerations are also discussed for each. GRA

N86-24015# Naval Surface Weapons Center, Silver Spring, Md.
CALCULATED AND MEASURED BATTERY VOLTAGES - THERMODYNAMICS AIDS IN IDENTIFYING ELECTROCHEMICAL REACTIONS Final Report, Mar. - Jun. 1984
Larry E. DeVries Feb. 1985 20 p
(AD-A163103; NSWC/TR-85-228) Avail: NTIS HC A02/MF A01 CSCL 10/3

Both the open and closed circuit voltages of a battery depend on the thermodynamic conditions inside the cell. When the actual electrochemical reaction of a particular battery is unknown, thermodynamic calculations can help to identify it. Using thermodynamics data, the open circuit voltages for alternatively electrochemical reactions can be calculated. When accurate data are available, the calculated voltage for the correct electrochemical reaction will agree to within millivolts with the measured value. For the Cl2-Li molten salt system, the calculated and measured values are both 3.612V at 2773K. For alkaline zinc batteries, the data indicate that Zn0 is the discharge product at the anode under ambient conditions. for the acid Mn02-Zn system, under the thermodynamic conditions, a two electron reduction of Mn02 occurs. Initially, in the alkaline Mn02-Zn system. Mn(OH) 4 is the discharge product at the cathode. GRA

N86-24016# Department of the Navy, Washington, D. C.
AN AIR-ELECTRIC POWERED HYBRID MOTOR Patent Application
Warren Seering, inventor (to Navy) Filed 2 Jul. 1985 11 p
(AD-D012052; US-Patent-Appl-SN-750952) Avail: NTIS HC A02/MF A01 CSCL 10/2

An air-electric powered hybrid motor combines the high performance and lightweight characteristics of a pressurized air-powered motor means which is coupled to an electric motor means having a high positional accuracy. The hybrid motor can be made reversible by interchanging symmetrical air input and output ports. GRA

N86-24017# Sandia National Labs., Albuquerque, N. Mex.
GaAs/SILICON MECHANICALLY STACKED, MULTIJUNCTION SOLAR CELL
J. M. Gee, R. Y. Loo, G. S. Kamath, and R. C. Knechtli 1985 15 p Presented at the 18th IEEE Photovoltaic Specialists Conference, Las Vegas, Nev., 21 Oct. 1985 Prepared in cooperation with Hughes Research Labs., Malibu, Calif.
(Contract DE-AC04-76DP-00789)
(DE86-002119; SAND-85-1205C; CONF-851043-9) Avail: NTIS HC A02/MF A01

A GaAs/silicon mechanically stacked, multijunction solar cell has been experimentally and theoretically investigated. Theoretical calculations predict efficiencies over 30% for this cell and indicate that the penalty for using a non-optimal combination of bandgaps is small when the cells are operated independently. Preliminary experiments achieved 24.7% at 70X. A detailed analysis of the experimental results allowed estimation of the various loss mechanisms in the stack and projection of the performance of an optimized stacked cell. An optimized GaAs/silicon MSMJ cell should be able to achieve efficiencies near 30% under concentration. DOE

N86-24018# Sandia National Labs., Albuquerque, N. Mex.
COMPARISON OF PHOTOVOLTAIC SYSTEM OPTIONS FOR TODAY'S AND TOMORROW'S TECHNOLOGIES
H. N. Post, D. E. Arvizu, and M. G. Thomas 1985 13 p Presented at the 18th IEEE Photovoltaic Specialists Conference, Las Vegas, Nev., 21 Oct. 1985
(Contract DE-AC04-76DP-00789)
(DE86-002120; SAND-85-1186C; CONF-851043-10) Avail: NTIS HC A02/MF A01

This paper presents a detailed cost comparison of five competing photovoltaic (PV) system options for large-size power plants. These five options include fixed, one-axis tracking and two-axis tracking flat plate collectors as well as concentrator collectors utilizing linear and point focus Fresnel optics. Total estimated system costs for each option are developed reflecting current technology as well as future technology expected in the mid-1990's timeframe. The main conclusion drawn from this comparison is that none of the five competing options in a high insolation location is a clear winner over the others for tomorrow's technologies. DOE

N86-24019# Pacific Northwest Lab., Richland, Wash.
BUSINESS DEVELOPMENTS OF NONTHERMAL SOLAR TECHNOLOGIES
S. A. Smith, R. L. Watts, and T. A. Williams Oct. 1985 45 p
(Contract DE-AC06-76RL-01830)
(DE86-002150; PNL-5628) Avail: NTIS HC A03/MF A01

Information on the developments of nonthermal solar technologies is presented. The focus is on the success of wind energy conversion systems (WECS) and photovoltaics. Detailed information on the installed generating capacity, market sectors, financing sources, systems costs and warranties of WECS and photovoltaic systems is summarized. DOE

N86-24020# Los Alamos National Lab., N. Mex.
GENERAL-PURPOSE HEAT SOURCE SAFETY VERIFICATION TEST SERIES: SVT-7 THROUGH SVT-10
T. G. George and D. Pavone Sep. 1985 53 p
(Contract W-7405-eng-36)
(DE86-003282; LA-10408-MS) Avail: NTIS HC A04/MF A01

The General-Purpose Heat Source (GPHS) is a modular component of the radioisotope thermoelectric generator that will supply power for the Galileo and Ulysses (formerly ISPM) space missions. The GPHS provides power by transmitting the heat of (238)PuO2 (ALPHA)-decay to an array of thermoelectric elements. Because the possibility of an orbital abort always exists, the heat source was designed and constructed to minimize plutonia release in any accident environment. The Safety Verification Test (SVT) series was formulated to evaluate the effectiveness of GPHS plutonia containment after atmospheric reentry and Earth impact. The first report (covering SVT-1 through SVT-6) described the results of flat and side-on module impacts. This report describes module impacts at angles of 15(0) and 30(0). DOE

N86-24021# Oak Ridge National Lab., Tenn.
ENERGY STORAGE OPTIONS FOR SPACE POWER
H. W. Hoffman, J. F. Martin, and M. Olszewski 1985 31 p Presented at the 2nd Symposium on Space Nuclear Power Systems, Albuquerque, N. Mex., 14 Jan. 1985
(Contract DE-AC05-84OR-21400)
(DE86-003307; CONF-850103-13) Avail: NTIS HC A03/MF A01

Including energy storage in a space power supply enhances the feasibility of using thermal power cycles (Rankine or Brayton) and providing high-power pulses. Review of storage options (superconducting magnets, capacitors, electrochemical batteries, thermal phase-change materials (PCM), and flywheels) suggests that flywheels and phase-change devices hold the most promise. Latent heat storage using inorganic salts and metallic eutectics offers thermal energy storage densities of 1500 to 2000 kJ/kg at temperatures to 1675 K. Innovative techniques allow these media

to operate in direct contact with the heat engine working fluid. Enhancing thermal conductivity and/or modifying PCM crystallization habit provide other options. Flywheels of low-strain graphite and Kevlar fibers have achieved mechanical energy storage densities of 300 kJ/kg. With high-strain graphite fibers, storage densities appropriate to space power needs (approx. 550 kJ/kg) seem feasible. Coupling advanced flywheels with emerging high power density homopolar generators and compulsators could result in electric pulse-power storage modules of significantly higher energy density. DOE

N86-24022# Pacific Northwest Lab., Richland, Wash.
ROTATIONALLY SAMPLED WIND AND MOD-2 WIND TURBINE RESPONSE Final Report
J. R. Connell, R. L. George, V. R. Morris, and V. A. Sandborn Nov. 1985 131 p
(Contract DE-AC06-76RL-01830)
(DE86-003367; EPRI-AP-4335) Avail: NTIS HC A07/MF A01

In an effort to learn more about how wind behaves near wind turbines, researchers rotationally sampled winds by attaching sensors to the blades of a MOD-2 wind turbine. This fieldwork demonstrates the feasibility of a blade-mounted measuring technique and provides new data on the winds encountered by a rotating turbine blade. DOE

N86-24023# Pacific Northwest Lab., Richland, Wash.
LONG-TERM PERFORMANCE AND COST GOALS FOR SOLAR THERMAL TECHNOLOGY
T. A. Williams Apr. 1985 18 p Presented at the American Society of Mechanical Engineers Winter Annual Meeting, Miami, Fla., 17 Nov. 1985
(Contract DE-AC06-76RL-01830)
(DE86-004023; PNL-SA-13036; CONF-851125-18) Avail: NTIS HC A02/MF A01

Long term performance and cost goals recently developed for the solar thermal technology are described. These goals were developed in support of the draft 1985 to 1989 National Solar Thermal Technology Program Five Year Research and Development Plan, and are intended to aid in planning research activities needed to make solar thermal energy an option which is both technically and economically attractive (DOE 1984). Goals were developed for both utility electric applications and for industrial process heat applications. Solar thermal technology goals are intended to provide targets, which when met, would result in the widespread usage of solar thermal technologies in the marketplace. The goals described include system goals and component goals. System goals are energy price targets which must be met for solar thermal to be economically viable in a given market. Component goals are performance and cost targets for the primary elements of a solar thermal plant (concentrators, receivers, etc.) which would allow achievement of the system level goal. DOE

N86-24024# Centre National de la Recherche Scientifique, Toulouse (France). Lab. d'Automatique et d'Analyse de Systemes.
THE REDUCTION OF RADIATION DAMAGE IN SOLAR CELLS. A STUDY OF RADIATION DEFECTS IN SILICON Final Report
Jacques Bernard (ONERA, Toulouse, France), Rene Reulet (ONERA, Toulouse, France), Michel Roux (ONERA, Toulouse, France) 06(Inst. Superieur d'Electronique du Nord, Lille, France), Danielle Bielle-Daspet, Michel Lagouin, Jacques Bourgoin, Didier Stievenard (Inst. Superieur d'Electronique du Nord, Lille, France), Luis Castaner-Munoz (Escuela Tecnica Superior de telecomunicacion, Barcelona, Spain), Ramon Alcubilla (Escuela Tecnica Superior de Ingenieros de Telecomunicacion, Barcelona, Spain), Luis Prat (Escuela Tecnica Superior de Ingenieros de Telecomunicacion, Barcelona, Spain) et al Paris ESA Jan. 1983 219 p refs
(Contract ESTEC-4510/80-NL-JS)
(LAAS-2755; ESA-CR(P)-2118) Avail: NTIS HC A10/MF A01

In order to quantitatively predict the degradtion of solar cells under space conditions a theoretical and experimental study was carried out. The effects of resistivity (10 and 1 ohm cm), doping (boron or gallium) and oxygen on the degradation induced by energetic electrons and illumination on silicon solar cells were evaluated. The room temperature degradation of GaAs structures was studied. A Gallium doped silicon appears promising for improved solar cells. Capacitance transient spectroscopy results show that the behavior of hole traps agrees with the variation of the solar cell parameters. The GaAs results indicate that the total recovery of the 1 MeV irradiation defects is obtained by 20 min annealing at 220 C, but defect production and recovery may vary with the structure technology. Author (ESA)

N86-24025# AEG-Telefunken, Wedel (West Germany).
ALTERNATIVE MODULE CONFIGURATIONS FOR ADVANCED SOLAR ARRAYS ON LOW ORBIT AND EXTENDED LIFETIME MISSIONS (AMOC 1) Final Report
D. Gringel, J. Koch, and W. Schmitz Paris ESA Jan. 1985 166 p
(Contract ESTEC-5508/83-NL-PB(SC))
(ESA-CR(P)-2129) Avail: NTIS HC A08/MF A01

The applicability and power improvement of the p-grid solar cell for low Earth orbit missions were assessed. The power improvement predicted analytically is confirmed by electrical performance measurements. Two measurement methods were used: separate illimination of front and rearside; and simultaneous illumination of front and rearside. Bifacial cells were bonded onto window type and continuous type substrates for electrical performance determination. Test samples composed of different substrate materials covered with solar cells or glass dummies were tested with respect to the expected thermal environment and mechanical behavior. Three favorable substrate designs were selected for a thermal cycling test: glass or carbon fiber reinforced Kapton modules, and treated glass cloth module. Electric performance increase is 10% to 15% after 15,000 cycles at plus or minus 100 C, compared to standard BSFR cells. Author (ESA)

N86-24026# Consultancy Services Wind Energy Developing Countries, Amersfoort (Netherlands).
COST OF WINDMILL IRRIGATION. COST ANALYSIS OF WIND PUMPS AND DIESEL PUMPS USED FOR SMALL SCALE IRRIGATION
A. M. Mueller and A. M. Jansen Jun. 1984 15 p
(CWD-84-3) Avail: NTIS HC A02/MF A01

A cost analysis and a method to make a quick economic comparison between wind pumps (water-pumping windmills) and diesel pumps (diesel powered water pumps) intended for use in small-scale lift irrigation are described. The analysis compares CWD wind pumps, designed for production in developing countries, with commercially available, traditional multiblade wind pumps. The variables required for comparison are: static lift, daily water requirement, and average wind speed during the period of irrigation. The analysis shows that for farmers engaged in small-scale lift irrigation on areas of up to 1 ha (2.5 acres), CWD wind pumps are economically more attractive than diesel pumps for average wind speeds during the irrigation season of > 3.5 m/sec (7.8 mph). Commercial wind pumps are more attractive than diesel pumps for an average wind speed of > 4.5 m/sec (10.1 mph).
Author (ESA)

N86-24027# Consultancy Services Wind Energy Developing Countries, Amersfoort (Netherlands).
TECHNICAL SPECIFICATIONS WIND PUMP MODELS CWD 2000, CWD 2740 AND CWD 5000 CW
1985 4 p
Avail: NTIS HC A02/MF A01

Technical specifications for windpowered pumps designed for developing countries are presented. Specifications include a service life of 10 yr, the use of locally available materials, the use of elementary construction techniques and equipment, and easy maintenance and servicing. The designs enable a decentralized production of windmills, while servicing may largely be done by the users themselves. Author (ESA)

N86-24028# Brookhaven National Lab., Upton, N. Y.
FUEL CELL REACTIONS IN SUPER ACID ELECTROLYTES

Annual Report, Jun. 1984 - Jun. 1985
W. E. OGrady Oct. 1985 36 p Sponsored by Gas Research Inst.
(PB86-125135; GRI-5081-260-0584) Avail: NTIS HC A03/MF A01 CSCL 07D

The series of acids including (CF3)2POOH, C6FCHFSO3H, SF5CHFSO3H, (CF3SO2)2CH2, CF3CHFSO3H and CF3CHFCF2WO3H have been tested as fuel cell electrolytes. The (CF3)2POOH and CgF5SO3H both have high vapor pressures and hence will not be useful as fuel cell electrolytes. Oxygen reduction in SF5CHFSO3H, (CF3SO2)2CH2 and CF3CHFSO3H is comparable to that obtained in the perfluoro mono and disulfonic acids tested previously and they show some promise. The CH3CHFCH2SO3H appears to have a different mechanism for oxygen reduction than all the previously tested acids. There is some question about the stability of CF3CHFCF2SO3H. It has been demonstrated that the entropy change occurring at the hydrogen electrode in the perfluorosulfonic acid is higher in normal mineral acids and it is a function of the acid concentration. GRA

N86-24529*# Alabama Univ., Huntsville. Dept. of Electrical and Computer Engineering.
MODELING AND ANALYSIS OF CASCADE SOLAR CELLS
Fat Duen Ho *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 23 p refs (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 10A

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N86-24029 California Univ., Davis.
RELATIONSHIP BETWEEN MODEL COMPLEXITY AND DATA BASE QUALITY FOR COMPLEX TERRAIN TRACER EXPERIMENTS AUT 01LANGE, ROLF Ph.D. Thesis
1985 150 p
Avail: Univ. Microfilms Order No. DA8521213

The relationship between numerical air quality model complexity and experimental data base quality (density) is examined for tracer scenarios in complex terrain under stable nighttime drainage flow conditions. To eliminate model to model incompatibilities and resolution variables, a single particle-in-cell model is developed that can be operated in a range of complexity, from a three-dimensional time variable transport and K-theory diffusion model with terrain to a simple steady state Gaussian plume model. The experimental data set used, consists of extensive meteorological data and tracer samples taken during a nighttime drainage flow tracer release scenario in an eight kilometer long valley. A matrix of computer runs was made on a CDC 7600, using a mass conservative transport and diffusion model in version of decreasing skill representing the rows, and meteorological input data sets of decreasing quality representing the columns. Dissert. Abstr.

N86-24030 Arkansas Univ., Fayetteville.
A LABORATORY STUDY OF SINGLE SULFATE AEROSOLS USING ELECTRODYNAMIC SUSPENSION Ph.D. Thesis
James Frederick Spann, Jr. 1984 107 p
Avail: Univ. Microfilms Order No. DA8528950

Bithermal isopiestic measurements of the water vapor pressure of the (NH4)2SO4-NH4HSO4-H2O system at room temperature were made using single nanogram particles electrodynamically suspended in a modified quadrupole trap. Particle composition changed from NH4HSO4 to (NH4)2SO4 as NH3 gas was absorbed in situ. Particle relative mass during solid liquid phase transformations was measured with an electrostatic balance. Constant water activity curves for both dilute and supersaturated solutions are displayed on a (NH4)2SO4-NH4HSO4-H2O phase diagram. From these measurements, a model is presented to explain the dynamics of dissolving mixed crystals. Applying electrolyte solution thermodynamics, values of the activity coefficient for aqueous solutions of (NH4)2SO4 and NH4HSO4 are calculated. The measured water activity of the various ammonium-hydrogen-sulfate solutions is compared to the predicted value of two models. The free energy of formation for the three crystalline structures of (NH4)2SO4, (NH4)3H(SO4)2 and NH4HSO4 is approximated using the Gibbes-Duhem relation and our measured values of saturated solutions. Dissert. Abstr.

N86-24031 Washington Univ., St. Louis, Mo.
THE CONTRIBUTION OF FINE PARTICLE SULFATES TO LIGHT SCATTERING IN ST. LOUIS Ph.D Thesis
Teri Lynn Vossler 1985 135 p
Avail: Univ. Microfilms Order No. DA8529983

The extent to which sulfates produce visibility reduction in the St. Louis area was examined. The contribution of fine aerosol sulfates to total light scattering was calculated from measured sulfur size distributions and Mie theory of light scattering. The aerosol was collected during both a summer and a winter season. Short sampling intervals (10 minutes to 3 hours) permitted observation of the fine structure of the sulfur size distribution and concentration, and involved only small changes in meteorology. Size separation was accomplished with an 8 stage low pressure impactor. Elemental sulfur was measured by flash volatilization and flame photometric detection. All fine sulfur was assumed to be in the form of (NH4)2SO4. Water which might be associated with this deliquescent aerosol was estimated. Two basic types of sulfur size distributions were observed. The most common type observed during the summer had a major sulfur mass peak between 0.5 micrometer and 1.0 micrometer in diameter. This size particle scatters light more efficiently than other particles. Calculation of individual sample scattering efficiencies indicated that during the summer, the (NH4)2SO4 fraction of the total particle light scattering increased with decreasing visibility. No such pattern was observed for the winter samples. The combination of large sulfate particles and high sulfate loadings led to the dominance of sulfates in visibility reduction during the summer. Dissert. Abstr.

N86-24032# Naval Ocean Systems Center, San Diego, Calif.
SPECIFICATION OF BUTYLTINS AND METHYLTINS IN SEAWATER AND MARINE SEDIMENTS BY HYDRIDE DERIVATIZATION AND ATOMIC ABSORPTION DETECTION Interim Technical Report, Jan. 1983 - Mar. 1985
A. O. Valkirs, P. F. Seligman, G. Vafa, P. M. Stang, and V. Homer Jul. 1985 44 p
(AD-A161872; NOSC-TR-1037) Avail: NTIS HC A03/MF A01 CSCL 08/10

A sensitive and selective speciation method for direct determination of butyltins in seawater and marine sediments has been developed from published methods previously discussed in scientific literature. Monobutyltin, dibutyltin, and tributyltin may be detected in natural seawater samples at concentrations below 0.01 microgram/liter. Sample stability during frozen storage in polycarbonate plastic containers were evaluated and found to be consistent over a 100-day storage period. Analysis of seawater samples by standard additions has compared well with butyltin concentrations, determined by callibration curve calculations in samples collected from open harbor sites. Less agreement between standard addition and calibration curve calculation of butyltin concentrations was seen when marine sediments were analyzed by direct borohydride derivatization. Greater problems with sample homogeneity and potential matrix interferences from high hydrocarbon and sulfide concentrations complicate marine sediment analysis. Some form of a sample pretreatment may be necessary to better determine butyltin concentrations in complex marine sediments. Author (GRA)

N86-24033# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Environmental Lab.
SOUTHWEST MISSISSIPPI TRIBUTARIES STUDY AREA ENVIRONMENTAL INVENTORY: WILDLIFE RESOURCES Final Report

Wilma A. Mitchell and Chester O. Martin Sep. 1985 41 p
(AD-A161894; WES/MLP/EL-85-3) Avail: NTIS HC A03/MF A01 CSCL 06/3

This report is an inventory and assessment of wildlife resources of the Southwest Mississippi Tributaries Basin. The study provides information on physiographic features, soils, land use and cover types, forest communities (including data and maps on forest cover), wildlife management areas, hunting and recreational uses of wildlife (including tabular summaries of harvest data), fur harvest and prices, nongame species, and threatened and endangered species. Supplemental information includes descriptions of the soils of countries within the basin, habitat capability indices for the Homochitto National Forest, fur bearer harvest data for counties in the basin for 1979 to 1983 breeding bird survey data obtained in Southwest Mississippi between 1966 and 1983, and 1973 to 1982 Christmas bird counts taken at Natchez, Miss. GRA

N86-24034# Army Cold Regions Test Center, APO Seattle, Wash. 98733.
VEGETATION AND ENVIRONMENTAL GRADIENTS OF THE PRUDHOE BAY REGION, ALASKA
Donald A. Walker Sep. 1985 238 p
(AD-A162022; CRREL-85-14) Avail: NTIS HC A11/MF A01 CSCL 06/3

The following topics are discussed: description of the region (topography, geology, climate, soils, wildlife, oil-field facilities, environmental impacts); microscale gradients; plant communities along the major microscale gradients, aerial analysis of vegetation and other geobotanical units, influence of microscale patterns on soil factors and individual plant taxa; mesoscale gradients; macroscale gradients; floristic analysis; growth of salix lanata along the summer temperature gradient; annotated plant checklist for the Prudhoe Bay region; environmental and species data for the permanent study plots; environmental and vegetation data summaries for all stand types; supplementary floristic data. GRA

N86-24035# Cambridge Univ. (England). Dept. of Engineering.
A WORKSHOP ON ENVIRONMENTAL TECHNOLOGY ASSESSMENT HELD AT THE UNIVERSITY OF CAMBRIDGE, ENGLAND HELD ON 24-26 APRIL, 1985
P. W. R. Beaumont, R. K. Jain, and R. S. Engelbrecht 1985 431 p Workshop held in Cambridge, England, 24-26 Apr. 1985
(Contract DAJA45-84-M-0363)
(AD-A162879) Avail: NTIS HC A19/MF A01 CSCL 13/2

The following topics are discussed: regulative and technical measures for air pollution control in the Federal Republic of Germany; abatement technologies for air pollutants; economic issues in the control of air pollution; megatrends in water treatment technologies; emerging technologies in the water supply industry, trends in water treatment technology (disinfection, oxidation and adsorption); water treatment research and development: a European viewpoint; wastewater treatment and management of resulting residues; wastewater treatment with coagulating chemicals; waste water treatment by fixed films in biological aerated filters; technologies for treatment and management of selected hazardous/toxic wastes; cement-based stabilization/solidification processes for the disposal of toxic wastes; hazardous waste: status and future trends of treating technologies; the EEC Directive on Environmental Assessment and its effect on UK environmental policy; environmental regulation formulation and administration; UK pollution control - legal perspectives; and evolution of technology strategies in environmental policy formulation. GRA

N86-24036# Spectral Sciences, Inc., Burlington, Mass.
HCL MONITOR. PHASE 1 Final Report, 19 Sep. 1984 - 19 Mar. 1985
L. S. Bernstein, M. W. Matthew, and F. Bien Dec. 1985 35 p
(Contract F08634-84-C-0312)
(AD-A163119; TR-74; AFESC/ESL-TR-85-25) Avail: NTIS HC A03/MF A01 CSCL 17/5

Because of potential environmental effects from the large quantities of HCl released into the atmosphere from Space Shuttle launches it is important to monitor the transport of HCl in both vapor and aerosol form into the surrounding areas. During Phase 1 of the Air Force 1984 to 1985 SBIR program, Spectral Sciences, Incorporated investigated the feasibility of developing a man portable HCl monitor capable of unattended operation. The major Phase 1 objectives were to experimentally demonstrate a novel infrared light source and to design an HCl monitor, based on the new infrared source, which would be build and field tested in Phase 2. The spectral output of the HCl infrared lamp was measured and was found to be consistent with earlier theoretical predictions. This HCl lamp was used in conjunction with a room temperature HCl absorption cell to demonstrate the potential sensitivity of the approach to measure small ambient HCl concentrations. Even with the relatively crude nature in which the emission-absorption measurements were made, it was possible to demonstrate detectable absorption down to 2 ppm for a field instrument. With the improved HCl lamp design and the real time self calibrating optical layout presented in this proposal, there is confidence that ambient HCl concentrations as low as 0.1 ppm can be detected with the Phase 2 instrument. GRA

N86-24037# Brookhaven National Lab., Upton, N. Y.
TRACE GAS AND AEROSOL MEASUREMENTS AT WHITEFACE MOUNTAIN, NEW YORK
T. J. Kelly Sep. 1985 116 p
(Contract DE-AC02-76CH-00016)
(DE86-002504; BNL-37110) Avail: NTIS HC A06/MF A01

This report presents the results of a 12-month program of atmospheric chemical measurements performed at Whiteface Mountain, New York. The purpose of this program was to study the concentrations and seasonal variability of several atmospheric chemical species which are of importance in the acid deposition issue. Whiteface Mountain (WFM) was chosen as the site of these measurements because it lies in the Adirondack Mountains of New York State, one of the areas considered susceptible to ecological damage from acid deposition. These measurements were the first long term study of atmospheric chemistry in the Adirondacks. Continuous real-time measurements of SO2 and NO sub x were made with commercial instruments modified for increased sensitivity and stability, and aerosol composition, HNO3 and SO2 were measured with a three-stage filter pack. The main conclusions of this work are: (1) that concentrations of gaseous SO2 and NO sub x are highest in the winter months, whereas their oxidation products SO4(2-) and HNO3 were highest in summer; (2) that aerosol acidity is closely associated with SO4(2-), aerosol NO3(-) concentrations being very low in all seasons; (3) and that the relative importance of aerosol acidity and HNO3 vary with season, because the strong seasonal variation in SO4(2-) results in a very strong seasonal variation in aerosol acidity. DOE

N86-24038# Brookhaven National Lab., Upton, N. Y.
POTENTIAL HEALTH AND SAFETY HAZARDS ASSOCIATED WITH THE PRODUCTION OF CADMIUM TELLURIDE, COPPER INDIUM DISELENIDE AND ZINC PHOSPHIDE PHOTOVOLTAIC CELLS
P. D. Moskowitz, V. M. Fthenakis, and J. C. Lee Apr. 1985 84 p
(Contract DE-AC02-76CH-00016)
(DE86-003122; BNL-51832) Avail: NTIS HC A05/MF A01

In large-scale manufacture of cadmium telluride, copper indium diselenide, and zinc phosphide photovoltaic cells, the materials and equipment used may present potential health and safety hazards to workers and the public. These hazards were identified by reviewing data on process materials, availability of control technology, biomedical effects, and health and environmental standards. Quantitative estimates of material inputs and outputs, and control technology costs for selected processes were based on preliminary engineering designs for hypothetical 10-MWp/yr photovoltaic cell production facilities. In the fabrication of these devices, unusually large quantities of some toxic gases may be used; large demands for phosphine and hydrogen selenide are of special concern. Because projected usage of these materials is much larger than the current one, a thorough evaluation of engineering controls will be needed before the technologies are commercialized. These materials could also present occupational

health hazards. Some management options to reduce occupational exposures to these materials are presented. Although specific federal and state regulations have not been promulgated for emissions from the photovoltaic industry, prudent engineering practice should be applied to all waste streams - solid, atmospheric, or liquid - containing toxic pollutants to limit discharges of these materials. Control costs for most atmospheric waste streams should not be large (<0.01 cent per watt); for phosphine, however, costs are potentially much larger (4.4 cents per watt). Some processes may also produce large quantities of solid waste defined as toxic or hazardous under US Environmental Protection Agency guidelines. Disposal costs for these materials are presented. DOE

N86-24039# Argonne National Lab., Ill.
PRACTICAL ASPECTS OF MEASURING DRY DEPOSITION, REVISION
M. L. Wesely and B. B. Hicks 1985 7 p Presented at the EPA/USGS/EPRI Workshop on Acid Deposition Monitoring and Analysis, Raleigh, N. C., 30 Apr. 1985 Prepared in cooperation with National Oceanic and Atmospheric Administration, Oak Ridge, Tenn.
(Contract W-31-109-eng-38)
(DE86-003054; CONF-8504158-2-Rev) Avail: NTIS HC A02/MF A01

The task of evaluating dry deposition presently falls into two categories: monitoring and direct measurement. The distinction is made because there is no simple method of direct measurement that can be used routinely. All of the currently popular flux-measurement methods (surface sampling, eddy correlation, etc.) are practical only for intensive studies of dry deposition processes. In this paper, our primary interest is in monitoring rather than short-term intensive studies of dry deposition. Dry deposition data are urgently needed for use in assessments and other activities for the National Acid Precipitation Assessment Program (NAPAP), for the following three types of applications: to document trends, both spatial and temporal; to provide information supporting effects studies; and to evaluate numerical models. DOE

N86-24040# Argonne National Lab., Ill.
DEVELOPMENT OF MONTHLY EMISSIONS TRENDS FOR RECENT YEARS
D. Knudson 1985 15 p Presented at the Annual Emissions Inventory Symposium, Charleston, S. C., 12 Nov. 1985
(Contract W-31-109-eng-38)
(DE86-004038; CONF-851155-2) Avail: NTIS HC A02/MF A01

As atmospheric transport and deposition modeling capabilities increase and monitoring data are accumulated, it becomes desirable to also have representative emissions data. The methodology and results of an effort to generate state-total source category-specific monthly SO2 and NO/sub x/ emission estimates for the period 1975-1983 are described. These data complement other data bases and support a variety of analytical efforts. The basis of the monthly emission estimates are source category-specific state-total SO2 and NO(sub x) emission values from the 1980 NAPAP emissions inventory. Annual emissions from the electric utility industry are allocated to monthly values using actual monthly fuel use for each year in the period. Annual emission values for other source groups were apportioned to monthly values using data which provides an indication of the monthly activity for each source group in the inventory year (1980). Annual state-total source category emission for other years in the period were derived from the EPA emissions trends data. The results indicate that intre-annual variability of SO2 and NO(sub x) emissions for each state depend on the variability of source categories contributing most to state total emissions. In states with SO2 emissions dominated by the electric utility sector, maximum emissions occur in the summer and winter. The relative of these two peaks depend on such factors as climate and utility prime mover and fuel mix. Monthly NO(sub x) emissions variations are also a function of the variability of source groups contributing the most to total state NO(sub x) emissions. In all states, vehicle fuel consumption contributes substantially to total state NO(sub x) emissions. Monthly variability of NO(sub x) emissions attributable to this source category shows only small variability in most states. DOE

N86-24041# Argonne National Lab., Ill.
ENHANCEMENT OF THE TOXIC VAPOR IDENTIFICATION CAPABILITY OF PORTABLE SENSORS USING PATTERN RECOGNITION TECHNIQUES
J. R. Stetter, S. L. Rose, P. C. Jurs, and J. O. Stull 1985 8 p Presented at the JANNAF Safety and Environmental Protection Subcommittee Meeting, Monterey, Calif., 4 Nov. 1985 Prepared in cooperation with Naval Research Lab., Washington, D.C., Pennsylvania State Univ., University Park, Coast Guard, Washington, D.C.
(Contract W-31-109-eng-38)
(DE86-004048; CONF-8511110-5) Avail: NTIS HC A02/MF A01

A portable instrument is being developed that can detect, identify, and warn US Coast Guard emergency response personnel of the presence of hazardous concentration of toxic gases and vapors. The toxic compounds are detected by an array of inexpensive, semiselective electrochemical sensors, and the complex output is analyzed using pattern recognition methods. The phototype device incorporates an array of four different electrochemical sensors, each of which can be operated in four different modes. The device thus obtains 16 channels of data for each chemical species present in the air sample. Pattern recognition analysis of these data can be used to determine the uniqueness of the information obtained for each of the 16 channels. A set of patterns for 22 gases and vapors detected with a chemical sensor array was examined. Results indicate that approximately half of the channels provide unique information and the data from 8 to 10 channels are sufficient to identify individual compounds. DOE

N86-24042# Oregon State Univ., Corvallis.
SIMULATED ACID RAIN ON CROPS
M. D. Plocher, S. C. Perrigan, R. J. Hevel, R. M. Cooper, and D. N. Moss Oct. 1985 74 p Sponsored in part by Corvallis Environmental Research Lab., Oreg.
(PB86-110772; EPA-600/3-85-068) Avail: NTIS HC A04/MF A01 CSCL 02D

In 1981, simulated H2SO4 acid rain was applied to alfalfa and tall fescue and a 2:1 ratio of H2SO4:HNO3 acid rain was applied to alfalfa, tall fescue, barley, wheat, potato, tomato, radish, and corn crops growing in the open field at Corvallis, Oregon. Effects of the acid rain on the appearance of the foliage were observed, and the effects on yield were measured. Because the effect of pH 4.0 rain on corn yield was the only significant effect noted in the 1981 studies, in 1982, more extensive studies of the effect of simulated H2SO4/HNO3 rain on corn were conducted. No significant effects of acid rain are found on foliage appearance, or on yield of grain or stover in the 1981 studies. GRA

N86-24043# Economic Research Service, Washington, D. C. Natural Resource Economics Div.
EFFECTS OF AIR POLLUTION AND ACID RAIN ON AGRICULTURE: AN ANNOTATED BIBLIOGRAPHY
J. R. Barse, W. Ferguson, and V. Whetzel Oct. 1985 186 p
(PB86-111630; AGES-850702) Avail: NTIS HC A09/MF A01 CSCL 02D

Ozone and sulfur dioxide-gaseous air pollutants can reduce the yields of key agricultural crops such as soybeans, corn, wheat, citrus fruit, cotton, and peanuts by interfering with plant photosynthesis. In general, the greater the pollutant concentration, the greater the yield reduction. Evidence on the biological impacts of acid rain on crops, soils, and forests is much less clear, often ambiguous. Some acid rain impacts can be favorable, because rainfall acids contain nitrogen and sulfur, major plant nutrients. GRA

N86-24044# Dartmouth Coll., Hanover, N.H. Dept. of Chemistry.
MEASUREMENTS OF POLYCYCLIC AROMATIC HYDROCARBONS IN AMBIENT AIR PARTICULATES IN NORTHERN NEW ENGLAND

J. F. Hornig, A. Barefoot, C. Parravano, and R. H. Soderberg Oct. 1985 17 p Sponsored in part by Environmental Protection Agency, Research Triangle Park, N.C. Prepared in cooperation with State Univ. of New York, Purchase
(PB86-117405; EPA-600/D-85-248) Avail: NTIS HC A02/MF A01 CSCL 07D

Polycyclic aromatic hydrocarbons (PAHs) in ambient air particulates in northern New England were measured. Standard high-volume filter samples of ambient-air particulates were collected during several heating seasons in a semirural village, a rural area, and in residential and institutional neighborhoods. A convenient and reproducible procedure based on extraction of the filters with cyclohexane using ultrasonic agitation, chromatography on silica gel, and extraction of the PAH fraction into dimethylsulfoxide was developed. Concentrations of 13 PAHs were determined by high performance liquid chromatography and by gas chromatography using both flame ionization and mass spectrometric detection. During 2 weeks of intensive sampling in late January 1982, the rural site showed the lowest PAH concentration, with Benz(a)pyrene (BaP) averaging about 1 microgram/cu m, compared to about 3 m/cu m in residential Hanover, N.H. The variations in both the concentrations of individual PAHs among sites and the variations in the relative concentrations of the different PAHs were surprisingly small. Both the total suspended particulates and the PAH concentrations correspond well with the degree-day weather. GRA

N86-24045# Environmental Protection Agency, Research Triangle Park, N.C. Atmospheric Sciences Research Lab.
CHEMISTRY AND CORROSIVENESS OF DEW
W. E. Wilson, E. O. Edney, and D. C. Stiles Oct. 1985 7 p
(PB86-119070; EPA-600/D-85-259) Avail: NTIS HC A02/MF A01 CSCL 07D

The impact of the deposition of acidic species on the degradation of commercially important materials such as metals and paints were examined. An effort was made to develop damage functions that can be employed to predict the extent of corrosion or erosion for a given set of environmental conditions. Regression analyses on corrosion data obtained from field studies were conducted which shed some light on which environmental factors play major roles in accelerating the degradation process above that expected due to natural weathering. It was established that the ambient SO2 concentration and the time the exposed surfaces are wet play important roles in the corrosion rate of metals. In order to evaluate the economic impact of various control strategies, reliable damage functions must be developed to predict the impact of a reduction in ambient SO2 concentration or the pH of the rain on the degradation process. GRA

N86-24046# Environmental Protection Agency, Research Triangle Park, N.C. Atmospheric Sciences Research Lab.
MODERN METHODS TO MEASURE AIR POLLUTANTS
R. K. Stevens Oct. 1985 62 p
(PB86-129798; EPA-600/D-85-260) Avail: NTIS HC A04/MF A01 CSCL 07D

The requirements for the collection and analysis of ambient particles to satisfy data requirements for source and receptor models as applied to pollution control applications are discussed. The following analytical procedures as applied to receptor modeling are described: X-ray fluorescence (XRF), neutron activation (NAA), ion exchange chromatography (IC), X-ray diffraction (XRD), optical microscopy (OM) and scanning electron microscopy (SEM), and the recent application of gas phase denuders to measure a wide range of pollutants, including nitric acid and ammonia. GRA

N86-24047# GCA Corp., Chapel Hill, N.C. Technology Div.
ASSESSMENT OF NOx EMISSION FACTORS FOR DIRECT-FIRED HEATERS Final Report, Dec. 1983 - Jan. 1985
C. R. Newman Oct. 1985 97 p
(Contract EPA-68-02-2693)
(PB86-119112; GCA-TR-CH-84-02; EPA-600/7-85-047) Avail: NTIS HC A05/MF A01 CSCL 06T

Emission factors for major categories of direct-fired heaters are reviewed. Systematic studies were analyzed to develop emission factors for oxides of nitrogen (NOx) at various levels of combustion air preheat used in major energy--consuming industries. Industrial fuel use in non-boiler applications amounted to about 60% of total industrial fuel consumption in 1980. The increasing use and potential for use of preheated combustion air for energy conservation may result in increased emissions of NOx from direct-fired process heaters. It is shown that NOx emission rates rise as combustion air temperature increases. It is indicated that a significant market for high temperature heat recovery equipment for use with many types of industrial sources will exist as they become proven and are applied to both new and existing sources. If these devices, which can preheat combustion air to 1093-plus C, are applied extensively, nationwide emissions of NOx could increase significantly. GRA

N86-24048# California State Dept. of Health, Berkeley. Air and Industrial Hygiene Lab.
CARCINOGENS AND MUTAGENS IN AMBIENT AIR PARTICULATE MATTER: SOURCES AND TRENDS IN CONTRA COSTA COUNTY Final Report
P. Flessel, G. Guirguis, K. Chang, and J. Lecocq Jun. 1985 191 p
(Contract ARB-A1-162-32)
(PB86-123841; CA/DOH/AIHL/SP-35; ARB-R-85/263) Avail: NTIS HC A09/MF A01 CSCL 13B

A method for measuring aerosol mutagens, the identification of sources of mutagens and the analysis of trends in mutagen and polycyclic aromatic hydrocarbon (PAH) levels in particulate organic matter (POM) is described. The microsuspension test was applied to measure the mutagenic activity in organic extracts of community aerosols. Application of the test made possible high resolution diurnal studies of mutagenicity in air samples of only 2 hours duration. The origins of mutagens in POM were investigated during seasonal pollution episodes. Samples were analyzed for mutagenic activity, PAH, NO3(-1), pollutant gases and elemental source tracers. Industrial contributions to mutagenic aerosols were suggested by significant positive correlations between mutagens and S at stations near oil refineries and chemical plants. Mutagens and PAH were also positively correlated with tracers for motor vehicles, (Br, CO) and secondary aerosols (NO3(-1). Levels of most pollutants, including mutagens and PAH, were highest in the winter. A positive trend in the concentration of mutagenic aerosols, despite decreasing or constant levels of other pollutants including PAH is revealed. GRA

N86-24049# Natioanl Center for Toxicological Research, Jefferson, Ark.
APPLICATION OF ATMOSPHERIC PRESSURE IONIZATION MASS SPECTROMETRY Final Report
R. K. Mitchum Oct. 1981 83 p refs
(PB86-117116; FDA/NCTR-86-29) Avail: NTIS HC A05/MF A01 CSCL 06T

Atmospheric pressure ionization mass spectrometry was developed. The stabilities of phenoxide anions was probed. Methodology was developed to analyze trace amounts of the phenoxy herbicide, 2,4,5-trichlorophenoxyacetic acid and its metabolites in diverse matrix components. The method was applied to the quantitation of 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) in tissue samples. Using a capillary column gas chromatograph interfaced directly to the atmospheric pressure ionization mass spectrometer, the concentration of TCDD was determined in environmentally exposed fish and wildlife. Isolation of TCDD from tissue samples was accomplished via a multistep fish high pressure liquid chromatography cleanup incorporating ring-labeled (sup 13)C(12)-TCDD as an isotope dilute. It is found that Polychlorinated biphenyls do not to interfere with the TCDD analyses at the low ppt level. The detection limit was found to be 10 ppt based upon a 50 g tissue sample. GRA

N86-24050# Illinois State Environmental Protection Agency, Springfield. Div. of Air Pollution Control.
ILLINOIS ANNUAL AIR QUALITY REPORT, 1984
Jun. 1985 133 p

(PB86-110780; IEPA/APC/85-006) Avail: NTIS HC A07/MF A01 CSCL 13B

Ambient air quality measurements obtained in Illinois during the calendar year of 1984 are summarized. Air quality data obtained for each site, statistical summaries, air quality violations and trend data where available are discussed. Back ground information is included converning sources of air pollutants, health effects, air quality standards and ambient monitoring methodologies. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation.*

N86-24051 Cornell Univ., Ithaca, N.Y.
EQUATORIAL ELECTRIC FIELDS: A NUMERICAL MODEL Ph.D. Thesis
Enivaldo Bonelli 1985 157 p
Avail: Univ. Microfilms Order No. DA8525767

Tidal winds in the ionospheric F region cause polarization charges to build up by blowing the ions perpendicular to the geomagnetic field. The intensity of the electric field so created is inversely related to the E region Pedersen conductivity. The reason for this is that the E region can short out F region electric fields through currents flowing along the magnetic field lines. The total electric field in the F region due to both these dynamos causes a plasma drift, affecting the interaction between neutrals and ions, and this closes the cycle. In the F region, the electron density is assumed to be a simple Chapman layer and the neutral density and temperature are obtained from Jacchia. The E region is treated as a thin layer, for which the conductivities are height integrated. This investigation studies the effects on the plasma drift of individual parameters such as the Pedersen conductivity of the E region, the phase of the (1,-2) tide in the E region, the motion of the F-peak, etc. The results for maximum and minimum solar activity agree well with the experimental data from Jicamarca, and our neutral wind exhibits a super rotation which increases with solar activity. A general result is that the velocity of the vertical drifts increases with altitude. Dissert. Abstr.

N86-24052 Cornell Univ., Ithaca, N.Y.
IONOSPHERIC TURBULENCE: CASE STUDIES IN EQUATORIAL SPREAD F AND DEVELOPMENT OF A ROCKET-BORNE INTERFEROMETER Ph.D. Thesis
James William LaBelle, III 1985 293 p
Avail: Univ. Microfilms Order No. DA8525716

In March, 1983, two rockets were launched into the disturbed nighttime equatorial F-region from Punta Lobos, Peru. The plasma density measurements from these flights confirm that the topside spread F plumes identifiable in the backscatter power maps produced at the nearly Jicamarca Radar Observatory are correlated with large scale density depletions. The downward gradients of these depletions are highly structured, consistent with the linear theory of the gravitational instability. The wavenumber spectrum associated with these density irregularities occasionally exhibits a K (spura-1.5) form for wavelengths longer than about one kilometer. These observations are shown to be consistent with the nonlinear theory of Sudan and Keskinen, although they also may be explained by at least two linear mechanisms: the generation of turbulence on the steepened walls of spread F bubbles, and the nonlocal role of the E-region in the development of spread F. In an attempt to resolve the ambiguities involved in measuring wavenumber spectra with sounding rockets, a number of rocket experiments involving spatially separated plasma density probes were performed at both high and low latitudes. Dissert. Abstr.

N86-24053 California Univ., Berkeley.
A SOUNDING ROCKET STUDY OF AURORAL ELECTRON PRECIPITATION Ph.D. Thesis
James Patrick McFadden 1985 141 p
Avail: Univ. Microfilms Order No. DA8525049

Measurement of energetic electrons in the auroral zone have proved to be one of the most useful tools in investigating the phenomena of auroral arc formation. A detailed analysis of the electron data from two sounding rocket campaigns and interprets the measurements in terms of existing auroral models. The results include the measurement of a narrow, magnetic field aligned electron flux at the edge of an arc. The payload also made simultaneous measurements of both energetic electrons and 3 MHz plasma waves in an auroral arc. The BIDARCA campaign consisted of two sounding rockets. The payloads reached respective apogees of 1020 km and 637 km while traveling within 50 km of the same magnetic field line. The measurements include 2 to 20 Hz fluctuations of a field aligned component of the electron distribution. This field aligned flux occurred over a broad energy range below the monoenergetic energy flux peak and showed dispersion between different energies. Dissert. Abstr.

N86-24054 California Univ., Berkeley.
SEISMIC VELOCITIES IN THE UPPER PART OF THE EARTH'S CORE Ph.D. Thesis
Patricia Ellen Murtha 1985 121 p
Avail: Univ. Microfilms Order No. DA8525062

The presence or absence of a significant boundary layer at the top of the outer core was investigated by determining an improved mean velocity model in this region. The data used in the velocity inversion are short period observations of the seismic phases SKS and ScS over the distance range 55 deg $<$ Delta $<$ 110 deg. For forward modeling, the distance range of SKS most sensitive to variations in the velocity at the top of the outer core is seen to be Delta $<$ 90 deg, and the position of Delta sub A, the distance where the first SKS ray entering the core emerges at the Earth's surface, is found to be extremely sensitive to the velocity at the top of the outer core. The ability to discriminate and identify SKS and ScS period data. Differential times between SKS and ScS phases as short as 4 s are read at distances of approximately 69 degrees. Observations of transversely polarized SKS are primarily due to anisotropy in the mantle and crust, as opposed to scattering near the core-mantle boundary, as was previously thought. Dissert. Abstr.

N86-24055 Texas A&M Univ., College Station.
FREE-AIR GRAVITY AND GEOID ANOMALIES OF THE NORTH ATLANTIC OCEAN AND THEIR TECTONIC IMPLICATIONS Ph.D. Thesis
Woo-Yeol Jung 1985 222 p
Avail: Univ. Microfilms Order No. DA8528335

A free air gravity anomaly map of the North Atlantic Ocean was constructed at a 10 mgal contour interval utilizing all available surface ship and pendulum gravity measurements. The map shows values more positive to the north of approx. 32 N than to the south and values more negative in the western North Atlantic Ocean basin than in the eastern basin. The Mid-Atlantic Ridge area and topographic highs such as volcanic islands, seamounts are associated with positive values while the rift valley and fracture zone valleys are characterized by elongated negative values. The seaward edge of the continental shelf is characterized by a belt of positive free air gravity anomalies; negative gravity values are observed just seaward of the continental slope and rise. A total of 3032 1 x 1 deg averaged free air gravity anomalies were determined from the surface ship gravity map. A gravimetric geoid was computed from these 1 x 1 deg averaged gravity anomalies by employing Stokes' integral theorem. Comparisons were made between the 1 x 1 deg surface ship gravity and the 1 x 1 deg SEASAT altimeter derived gravity as well as the 1 x 1 deg surface ship gravimetric geoid and the 1 x 1 deg SEASAT altimeter derived geoid. The results show very good agreement in contour trends, wavelengths and amplitudes. Author

N86-24056 Minnesota Univ., Minneapolis.
MEASUREMENT OF TRACE GASES IN THE STRATOSPHERE WITH A MASS SPECTROMETER SYSTEM Ph.D. Thesis

Daniel Mark Murphy 1985 88 p
Avail: Univ. Microfilms Order No. DA8526493

Measurements of trace gases in the stratosphere were performed with a balloon borne molecular beam sampling system and mass spectrometer. The sensitivity the mass spectrometer was extended by a microchannel plate detector system that simultaneously collected ions over a wide range of masses. The microchannel plate detector operates in an ion counting mode. Ions striking the microchannel plate release pulses of electrons which are amplified and accelerated to a phosphor layer. The resulting flash of light is carried by a fiber optic bundle to a photodiode array. The output of the array is then fed through a discriminator to find the locations of the pulses. Each mass can be measured independently at count rates between 0.02 and 1000 counts/s. A profile of ozone was obtained and noble gas isotopes with mixing ratios in the ppb range were measured. Detection limits of 50 ppt are possible for the mass spectrometer system. This will allow the measurement of several species of great interest in stratospheric chemistry, including ClO and the isotopes of ozone. Dissert. Abstr.

N86-24057 Colorado Univ., Boulder.
A THEORETICAL AND OBSERVATIONAL INVESTIGATION OF THE RESPONSE OF OZONE TO SHORT-TERM VARIATIONS IN THE SOLAR ULTRAVIOLET IRRADIANCE Ph.D. Thesis
Richard Scott Eckman 1985 216 p
Avail: Univ. Microfilms Order No. DA8528481

An analysis of the response of middle atmospheric ozone to short-term variations in the solar ultraviolet irradiance is presented. Measurements of ozone from the Solar Mesosphere Explorer (SME) ultraviolet spectrometer (UVS) are compared to the calculations of a one dimensional, radiative-photochemical model of the upper stratosphere and lower mesosphere. The model uses temporally varying solar UV irradiances measured by the SME solar spectrometer. Measurements made by the SME UVS in the 0.1 to 1 mb range show evidence that tropical ozone responds to solar rotational variation when analyzed using both frequency and time domain techniques. Analysis of ozone variations at extratropical latitudes revealed different periodicities that were not correlated with solar variations. Calculations of the amplitude and phase of the ozone response due to solar UV oscillations made by the model show that the effects of the coupling of radiation and photochemistry in the region near the stratopause may not be neglected. Dissert. Abstr.

N86-24058 Alaska Univ., Fairbanks.
AURORAL ZONE THERMOSPHERIC DYNAMICS USING FABRY-PEROT INTERFEROMETRIC MEASUREMENTS OF THE OI 15867K EMISSION Ph.D. Thesis
Robert Joseph Sica 1984 245 p
Avail: Univ. Microfilms Order No. DA8528691

Forty-four nights of thermospheric neutral wind and temperature measurements were obtained from College, Alaska during solar maximum using a ground based Fabry-Perot interferometer. When averaged by increasing geomagnetic activity, the wind exhibits two main features. First, the general flow pattern, poleward and westward in the evening, changing to southward and eastward in the morning, persists with increasing activity. The flow velocity increases and the change in direction occurs earlier in magnetic local time as the geomagnetic activity increases. Second, as the activity increases, the meridional wind pattern shifts equatorward with the auroral oval. Consequently, the low geomagnetic activity average wind pattern in the north is similar to the moderate activity average pattern in the south. The average thermospheric temperature is governed by the geomagnetic activity and by the previous day's 10.7 cm solar flux. The increase in temperature with solar flux is about the same as with auroral activity. The dynamical behavior of individual nights highlights the importance of local auroral substorms, which can cause large deviations from both global models and the observed averages. Author

N86-24059*# Arizona Univ., Tucson. Dept. of Planetary Sciences.
STUDIES OF EXTENDED PLANETARY ATMOSPHERES Final Report, 1 Oct. 1979 - 30 Sep. 1985
D. M. Hunten, S. T. Massie, and L. L. Hood 14 Apr. 1986 5 p
(Grant NsG-7485)
(NASA-CR-176719; NAS 1.26:176719) Avail: NTIS HC A02/MF A01 CSCL 04A

There was a theoretical study of physical and chemical processes in the stratosphere, later broadened to include the mesosphere. Particular emphasis was laid on testing of proposed height profiles of the eddy diffusion coefficient against observed tracer data. Eventually the effort shifted to study of ozone time series in satellite data, and interpretation in terms of aeronomical processes. Since all this work is computer-intensive, the first year of funding also contributed to the acquisition of a powerful minicomputer system, in collaboration with several other faculty members. This proved to be highly successful and cost effective. Author

N86-24060*# National Aeronautics and Space Administration, Washington, D.C.
ELECTRICAL CONDUCTIVITY OF ROCKS AT HIGH PRESSURES AND TEMPERATURES
E. I. Parkhomenko and A. T. Bondarenko Jan. 1986 299 p refs
Transl. into ENGLISH of the book " Elektroprovodnost Gornykh Porod Privysokikh Davleniyakh i Temperaturakh" Moscow (USSR), Nauka, 1972 p 1-212 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-4005)
(NASA-TM-77687; NAS 1.15:77687) Avail: NTIS HC A13/MF A01 CSCL 08G

The results of studies of the electrical conductivity in the most widely distributed types of igneous rocks, at temperatures of up to 1200 C, at atmospheric pressure, and also at temperatures of up to 700 C and at pressures of up to 20,000 kg/sq cm are described. The figures of electrical conductivity, of activaation energy and of the preexponential coefficient are presented and the dependence of these parameters on the petrochemical parameters of the rocks are reviewed. The possible electrical conductivities for the depository, granite and basalt layers of the Earth's crust and of the upper mantle are presented, as well as the electrical conductivity distribution to the depth of 200 to 240 km for different geological structures. Author

N86-24061*# Montana State Univ., Bozeman. Dept. of Earth Sciences.
AN ARCHEAN SUTURE ZONE IN THE TOBACCO ROOT MOUNTAINS? (1984) EVOLUTION OF ARCHEAN CONTINENTAL CRUST, SW MONTANA (1985) Final Technical Report
David W. Mogk and Lawrence Kain 1985 144 p refs
(Grant NAG9-68)
(NASA-CR-176726; NAS 1.26:176726) Avail: NTIS HC A07/MF A01 CSCL 08G

The Lake Plateau area of the Beartooth Mountains, Montana were mapped and geochemically sampled. The allochthonous nature of the Stillwater Complex was interpreted as a Cordilleran-style continental margin. The metamorphic and tectonic history of the Beartooth Mountains was addressed. The Archean geology of the Spanish Peaks area, northern Madison Range was addressed. A voluminous granulite terrain of supracrustal origin was identified, as well as a heretofore unknown Archean batholithic complex. Mapping, petrologic, and geochemical investigations of the Blacktail Mountains, on the western margin of the Wyoming Province, are completed. Mapping at a scale of 1:24000 in the Archean rocks of the Gravelly Range is near completion. This sequence is dominantly of stable-platform origin. Samples were collected for geothermometric/barometric analysis and for U-Pb zircon age dating. The analyses provide the basis for additional geochemical and geochronologic studies. A model for the tectonic and geochemical evolution of the Archean basement of SW Montana is presented. E.A.K.

N86-24062# Indian Inst. of Geomagnetism, Bombay.
INDIAN INSTITUTE OF GEOMAGNETISM: PROGRESS IN

RESEARCH Annual Report, 1983-1984
[1984] 87 p
Avail: NTIS HC A05/MF A01

Progress and aspects is the study of the geomagnetic variations in the Indian region on quiet and disturbed days, equatorial electrojet field, electromagnetic induction in the earth, magnetic pulsations, aeronomy, radio scintillations, magnetosphere and solar wind, and solar-terrestrial relationships were reported. E.A.K.

N86-24063*# Colorado Univ., Boulder. Dept. of Astrophysical, Planetary and Atmospheric Sciences.
CONSTRAINTS ON GEOMAGNETIC SECULAR VARIATION MODELING FROM ELECTROMAGNETISM AND FLUID DYNAMICS OF THE EARTH'S CORE Final Report, 18 Oct. 1984 - 28 Feb. 1986
Edward R. Benton 28 Feb. 1986 58 p refs
(Contract NAS5-28617)
(NASA-CR-177857; NAS 1.26:177857) Avail: NTIS HC A04/MF A01 CSCL 08N

A spherical harmonic representation of the geomagnetic field and its secular variation for epoch 1980, designated GSFC(9/84), is derived and evaluated. At three epochs (1977.5, 1980.0, 1982.5) this model incorporates conservation of magnetic flux through five selected patches of area on the core/mantle boundary bounded by the zero contours of vertical magnetic field. These fifteen nonlinear constraints are included like data in an iterative least squares parameter estimation procedure that starts with the recently derived unconstrained field model GSFC (12/83). Convergence is approached within three iterations. The constrained model is evaluated by comparing its predictive capability outside the time span of its data, in terms of residuals at magnetic observatories, with that for the unconstrained model. Author

N86-24064# Naval Research Lab., Washington, D. C.
THEORY OF THE CURRENT-DRIVEN ION CYCLOTRON INSTABILITY IN THE BOTTOMSIDE IONOSPHERE
P. Satyanarayana, P. K. Chaturvedi, M. J. Keskinen, J. D. Huba, and S. L. Ossakow 11 Nov. 1985 49 p
(AD-A161862; NRL-MR-5656) Avail: NTIS HC A03/MF A01 CSCL 04/1

A theory of the current-driven electrostatic ion cyclotron(EIC) instability in the collisional bottomside ionosphere is presented. It is found that the electron collisions are destabilizing and are crucial for the excitation of the EIC instability in the collisional bottomside ionosphere. Furthermore, the growth rates of the ion cyclotron instability in the bottomside ionosphere maximize for (K-perpendicular) (rho sub i) > or = 1 where 2 pi/K-perpendicular is the mode scale size perpendicular to the magnetic field and rho sub i the ion gyroradius. Realistic plasma density and temperature profiles typical of the high latitude ionosphere are used to compute the altitude dependence of the linear growth rate of the maximally growing modes and critical drift velocity of the EIC instability. The maximally growing modes corresponds to observed meter size irregularities and the threshold drift velocity required for the excitation of EIC instability is lower for heavier (NO+0+) ions than that for the lighter (H+) ions. Dupree's resonance broadening theory is used to estimate nonlinear saturated amplitudes for the ion cyclotron instability in the high latitude ionosphere. Comparison with experimental observations is also made. It is conjectured that the EIC instability in the bottomside ionosphere could be a source of transversely accelerated heavier ions and energetic heavy ion conic distributions at higher altitudes. GRA

N86-24065# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
THE AFGL (AIR FORCE GEOPHYSICS LABORATORY) ABSOLUTE GRAVITY SYSTEM'S ERROR BUDGET REVISTED Environmental Research Papers, Jan. 1984 - May 1985
Robert L. Iliff and Roger W. Sands 8 May 1985 24 p
(AD-A162230; AFGL-TR-85-0102; AFGL-ERP-915) Avail: NTIS HC A02/MF A01 CSCL 20/8

The error budget for the absolute gravity measuring instrument has been reevaluated for the purpose of locating and correcting an apparent bias that appeared in the data at the gravity lab early in 1981. The results of this analysis reveal a major equipment-induced error and minor data reduction errors. Revised gravity values at various sites across the U.S. and Sevres, France are given along with values obtained with other instruments at collocated sites. GRA

N86-24066# Florida Univ., Gainesville. Dept. of Civil Engineering.
GENERALIZED PHENOMENOLOGICAL CYCLIC STRESS-STRAIN-STRENGTH CHARACTERIZATION OF ANISOTROPIC GRANULAR MEDIA Annual Report, 1 May - 1 Jun. 1985
Devo Seereeram, Michael C. McVay, and Paul F. Linton 27 Jun. 1985 264 p
(Grant AF-AFOSR-0108-84)
(AD-A162348; AFOSR-85-1023TR) Avail: NTIS HC A12/MF A01 CSCL 08/13

An analytical and experimental investigation into the influences of material anisotropy and principal plane rotation on the stress-strain and strength behavior of granular soil (Reid-Bedford Sand) is conducted. The laboratory investigation entailed the performance of approximately fifteen triaxial tests under conventional compression and extension loading, and five through initial shear, followed by hydrostatic compression. The initial tests with an additional fifteen experiments were used in characterizing the influence of inherent anisotropy and principal plane rotations on material response. The latter were employed to delineate the effects of stress-induced anisotropy. A review of existing elasto-plastic theory as related to soil mechanics showed only a few models of a phenomenological nature which of the multi-surface isotropic/kinematic hardening characterizations, Prevost's pressure sensitive model, was used in the prediction of the hollow cylinder tests. Although the model reasonably reproduced the response along its calibration path, it did not quantitatively or qualitatively predict the laboratory results along other stress paths which involved principal plane and the need for improved analytical representation. GRA

N86-24067# Naval Research Lab., Washington, D. C.
PRODUCTION AND CONTROL OF ION CYCLOTRON INSTABILITIES IN THE HIGH LATITUDE IONOSPHERE BY HIGH POWER RADIO WAVES
P. K. Chaturvedi, M. J. Keskinen, and S. L. Ossakow 30 Dec. 1985 22 p
(AD-A163075; NRL-MR-5667) Avail: NTIS HC A02/MF A01 CSCL 04/1

The possible generation and suppression of ion cyclotron waves in a collisional plasma by external high power electromagnetic (EM) waves with frequency close to the local upper-hybrid frequency is considered. It is shown that the ion cyclotron instability can be destabilized or (stabilized) for omega(o) < omega (UH) Omega(o) >Omega(UH), where omega(o) is the pump frequency of the EM wave. The results are applied to naturally occurring ion cyclotron instabilities in the high latitude ionosphere. GRA

N86-24068*# Stanford Univ., Calif. Center for Space Science and Astrophysics.
FORCE-FREE MAGNETIC FIELDS
W. H. Yang, S. K. Antiochos, and P. A. Sturrock Nov. 1985 29 p
(Grants NGL-05-020-272; NAGw-92; Contract N00014-85-K-0111)
(NASA-CR-176767; NAS 1.26:176767; AD-A163090;
SU-CSSA-ASTRO-85-35) Avail: NTIS HC A03/MF A01 CSCL 03/2

The problem under discussion is that of calculating magnetic field configurations in which the Lorentz force j x B is everywhere zero, subject to specified boundary conditions. We choose to represent the magnetic field in terms of Clebsch variables in the form B = grad alpha x grad beta. These variables are constant on any field line so that each field line is labeled by the corresponding values of alpha and beta. When the field is described in this way, the most appropriate choice of boundary conditions is to specify the values of alpha and beta on the bounding surface. We show that such field configurations may be calculated by a

magneto-frictional method. We imagine that the field lines move through a stationary medium, and that each element of magnetic field is subject to a frictional force parallel to and opposing the velocity of the field line. This concept leads to an iteration procedure for modifying the variables alpha and beta, that tends asymptotically towards the force-free state. We apply the method first to a simple problem in two rectangular dimensions, and then to a problem of cylindrical symmetry that was previously discussed by Barnes and Sturrock (1972). In one important respect, our new results differ from the earlier results of Barnes and Sturrock, and we conclude that the earlier article was in error. GRA

N86-24069# Lawrence Livermore National Lab., Calif.
PHYSICAL PHENOMENA INDUCED BY PASSAGE OF INTENSE ELECTROMAGNETIC PULSES (INCLUDING CO2 LASERS) THROUGH THE ATMOSPHERE
J. H. Yee, D. J. Mayhall, and R. Alvarez 23 Oct. 1985 14 p refs Presented at the 7th International Workshop on Laser Interaction and Related Plasma Phenomena, Monterey, Calif., 28 Oct. 1985
(Contract W-7405-eng-48)
(DE86-002132; UCRL-93523; CONF-851053-1) Avail: NTIS HC A02/MF A01

The electron fluid equations are combined with Maxwell's equations to investigate the physical phenomena that occurs when short, intense electromagnetic pulses (including the CO2 laser pulse) interact with the atmosphere. The phenomena of tailed erosion occurs when the pulse intensity exceeds the air-breakdown threshold. In some cases, the erosion of the pulse occurs first in the middle of the pulse and then occurs in the tail of the pulse. In addition, we discovered that the amount of the energy that a pulse carries through the atmosphere is independent of whether it is propagating vertically upward from the Earth's surface or vertically downward toward the Earth's surface, provided the distance the pulse travels is the same for both directions of the propagation. DOE

N86-24070# Sandia National Labs., Albuquerque, N. Mex.
ESTIMATION OF SEISMIC SPATIAL COHERENCE AND ITS APPLICATION TO A REGIONAL EVENT
J. P. Claassen Nov. 1985 113 p refs
(Contract DE-AC04-76DP-00789)
(DE86-003792; SAND-85-2093) Avail: NTIS HC A06/MF A01

Inhomogeneities in the Earth's crust produce scattering, multipathing, reverberation and mode conversion. The degree to which the signals are correlated is dependent on the geologic structure beneath the array, between the event and the array, and to some degree around the event. Since coherent beam formation requires replicated signals except for noise at each receiver, the diameter of seismic arrays must be restricted to spans over which the signals remain spatially coherent. If seismic arrays are to be important elements in a regional network that performs seismic verification functions for a Comprehensive Test Ban Treaty, the influence of crustal geology on seismic spatial coherence must be well understood. This report was written to: (1) address problems in estimating the spatial coherence of seismic signals, (2) demonstrate a coherence estimator on a single event, (3) show how spatial coherence influences the performance of regional seismic arrays in a seismic verification context, and (4) establish parameters useful for designing arrays in geologic shields. Specifically, it is shown that the Blackman-Tukey spectral estimation method can be adapted in a straightforward way to estimate spatial coherence. The pitfalls in estimating spatial coherence are discussed and practical methods for abating their effects are introduced. The spatial coherence estimation theory is then applied to a single regional event that had been observed by the Norwegian Regional Seismic Array (NRSA) on the Fenno-Scandinavian shield. The distances over which the signals remain coherent are then inferred from the coherence estimates through an exponential model for spatial decorrelation. Correlation distances at various frequencies over a 1 to 20 Hz bandwidth for the four regional arrivals, P sub n, P sub g, S sub n, and L sub g, are identified. DOE

N86-24071# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
MAGNETOSPHERE-IONOSPHERE COUPLING
C.-G. Faelthammar May 1985 77 p refs Presented at ESA Workshop on Future Missions in Solar, Heliospheric and Space Plasma Phys., Garmisch-Partenkirchen, West West Germany, 30 Apr. - 3 May 1985
(TRITA-EPP-85-06; ISSN-0348-7539) Avail: NTIS HC A05/MF A01

Magnetosphere-ionosphere coupling, and the role of Birkeland currents, magnetic-field aligned electric fields, and Alfven waves are discussed. In addition to transporting energy and momentum between the magnetosphere and the ionosphere, the Birkeland curents cause a redistribution of matter within and between these regions. They do so directly via exchange of charge carriers, and indirectly via instabilities and acceleration processes that they excite in the plasmas. The spatial distribution of magnetic-field aligned electric fields, and the way they are supported are unclear. Changes in electric fields and plasma convection are communicated between the magnetosphere and the ionosphere by Alfven waves. Observations of high power low frequency noise, which fits an Alfven wave description, and which has a net downward Poynting flux of 100 million W integrated over the auroral regions are reported. Individual Alfven waves, upward and downward propagating, are observed. Oblique Alfven waves are a key feature of a model for auroral arc formation.
Author (ESA)

N86-24072# Ohio State Univ., Columbus. Inst. of Polar Studies.
SCIENTIFIC PLAN FOR DEEP ICE CORE DRILLING IN CENTRAL GREENLAND (GISP 2: GREENLAND ICE SHEET PROJECT)
E. Mosley-Thompson, A. J. Gow, M. M. Herron, K. Jezek, and B. Kamb 1985 108 p refs
(Contract NSF DPP-84-13028)
(PB86-123197; NSF-DPP84-13028) Avail: NTIS HC A06/MF A01 CSCL 08L

Ice sheets are natural archival systems that continously collect and preserve the physical and chemical history of the Earth's atmosphere. Ice cores drilled from the ice sheets offer a practical way to study the layers of ice. Deep ice cores have been drilled to bedrock only three times: at Camp Century, Greenland, in 1966 (1,384 meters), at Byrd Station, Antarctica, in 1968 (2,164 meters), and at Dye-3, Greenland, in 1979 (2,037 meters). The Dye-3 core was collected as part of the Greenland Ice Sheet Project (GISP). The scientific objective of GISP 2 is to unlock the 200-millenia or longer record of climate and atmospheres in the 3,200-meter-thick ice of central Greenland. The report describes objectives of U.S. scientists; Danish and Swiss objectives are similar. A science plan includes establishing the depth-age scale, temperature and precipitation history, history of atmospheric gases and aerosols, dynamics and physical state of the ice sheet, modeling, and complimentary studies. GRA

N86-24073# Environmental Protection Agency, Research Triangle Park, N.C. Atmospheric Sciences Research Lab.
ATMOSPHERIC DIFFUSION MODELING BASED ON BOUNDARY LAYER PARAMETERIZATION Final Report
J. S. Irwin, S. E. Gryning, A. A. M. Holtslag, and B. Sivertsen Sep. 1985 55 p refs Prepared in cooperation with Riso National Lab., Roskilde, Denmark, Norsk Inst. for Luftorskning, Lillestroem, Norway and Royal Netherlands Meteorological Inst., De Bilt, Netherlands
(PB86-103660; EPA-600/3-85-056) Avail: NTIS HC A04/MF A01 CSCL 04A

Methods for processing meteorological data for use in air quality diffusion modeling are outlined. The current concepts for the idealized states of the planetary boundary layer were applied. A number of models are recommended. Several of the models characterize directly the crosswind integrated concentration at the surface, thus avoiding whenever justified the assumption of a Gaussian distribution of material in the vertical. The goal is to characterize the meteorological conditions affecting the diffusion

for transport distances on the order of 10 km or less. Procedures are suggested for estimating the fundamental scaling parameters. For obtaining the meteorological data needed for estimating the scaling parameters, a minimum measurement program is recommened. Methods are presented for the determination of the scaling parameters and methods are suggested for estimating the vertical profiles of wind velocity, temperature, and the variances of the vertical and lateral wind velocity fluctuations. Author

N86-24074# Norsk Inst. for Luftforskning, Lillestroem.
ATMOSPHERIC DISPERSION MODELING BASED UPON BOUNDARY LAYER PARAMETERIZATION
B. Silvertsen, S. E. Gryning, A. A. M. Holtslag, and J. S. Irwin Oct. 1985 21 p refs Sponsored by EPA
(PB86-110699; EPA-600/D-85-224) Avail: NTIS HC A02/MF A01 CSCL 04A

Characteristic scaling parameters in the planetary boundary layer have been applied to estimate the dispersion of nonbuoyant gaseous pollutants. Vertical and lateral spread are tested separately, and the choice of parameters for the dispersion models depends upon the actual state of the planetary boundary layer. The lateral concentration distribution at the surface was usually found to be a Gaussian distribution. The vertical concentration distribution was more often other than Gaussian. For the different scaling regions of the atmosphere, methods are proposed for estimating the crosswind integrated concentrations, as functions of distance from the source, and are compared using results from tracer experiments. The proposed methods estimate the transport and dispersion directly from the turbulent state of the atmosphere. The turbulence, and thus the dispersion, is better explained and modeled in the surface layer of the atmosphere (stable and unstable), than within the layers above the surface layer. GRA

N86-24520*# North Georgia Coll., Dahlonega. Dept. of Physics.
DENSITY AND PRESSURE VARIABILITY IN THE MESOSPHERE AND THERMOSPHERE
T. Michael Davis *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 27 p refs (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 04A

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N86-24075 National Oceanic and Atmospheric Administration, Washington, D. C.
NOAA ATLAS: AN ATLAS OF SATELLITE-DERIVED NORTHERN HEMISPHERIC SNOW COVER FREQUENCY
Michael Matson, Chester F. Ropelewski, and Marylin S. Varnadore Mar. 1986 149 p
Avail: NTIS HC A07/MF A01

This atlas presents 15 years (1967 to 1981) of satellite derived snow cover data in the form of monthly and midmonth to midmonth snow cover frequency maps. The maps are in two general formats: frequency of snow cover incremented in 10 percent intervals and contour maps incremented in 25 percent intervals. In addition to the maps, tables and time series of Eurasian and North American snow cover are presented. Author

N86-24076 Colorado Univ., Boulder.
A COMPARISON OF TWENTIETH CENTURY CLIMATIC ANOMALIES IN NORTHERN NORTH AMERICA WITH RECONSTRUCTED PATTERNS OF TEMPERATURE AND PRECIPITATION BASED ON POLLEN AND TREE-RING DATA Ph.D. Thesis
Henry Frank Diaz 1985 255 p
Avail: Univ. Microfilms Order No. DA8528479

The possibility of significant climatic changes over the next century or two resulting from anthropogenic modification of atmospheric composition and vegetative alterations makes it important to determine the ranges associated with different climatic regimes that have occurred during the present interglacial. The approach taken was to use the modern observational record to identify the surface anomaly patterns and the associated midtropospheric circulation features characteristic of the principal modes of interannual variance in this region. These anomaly patterns were analyzed within the context of the annual cycle by looking at seasonal variations and by comparison with the mean season-to-season changes. Principal component analysis was one major tool used to derive objectively the characteristic anomaly fields at both the surface and upper levels and to assess their temporal relationships. The surface patterns were contrasted to those derived using climate proxy data, such as variations in tree ring growth and fossil pollen variations in order to infer plausible circulation regimes based on the degree of pattern similarity. Areas of consistent response during warm and/or cold periods operating at time scales varying from years to decades to centuries and finally to the order of millennia were identified and their existence was explained in terms of the possible redistribution (i.e., changes in the mean position and strength) of the planetary-scale waves in this region. Dissert. Abstr.

N86-24077 Minnesota Univ., Minneapolis.
CLIMATE SENSITIVITY OF A NUMERICAL MODEL OF ICE-SHEET DYNAMICS AND THERMODYNAMICS Ph.D. Thesis
Brian Harley Hanson 1985 201 p
Avail: Univ. Microfilms Order No. DA8526418

The climate of the Earth is a complex of interacting parts, of which ice sheets vary most slowly. Ice sheets have been coupled to climate only in the simplest models because of the great differences in the time scales of their responses, and because the models previously used for ice sheets have had limited physical capabilities in their responses to climatic influences. A finite element model developed here responds realistically to climatic forcing. The model uses the method of weighted residuals to solve the general equations for steady motion of a nonlinear viscous medium and for energy conservation with forced advection, internally generated heat, and diffusion in a two dimensional, vertical flow-plane. Model performance is verified against theoretical solutions for velocity and temperature in idealized geometries, including a transient temperature solution developed here. A number of experiments using the finite element model simulated a flowplane on the south dome of Barnes Ice Cap on Baffin Island. Velocity calculations show that while shear stresses still play the major role in the stress balance of the ice sheet, much of the apparent deformation of the ice results from longitudinal stresses. The response of the model to small, forced changes in boundary condition temperature is linear and symmetric with respect to rising or falling temperatures. Dissert. Abstr.

N86-24078 Kansas Univ., Lawrence.
THE ADVANCE OF PHENOLOGICAL SPRING ACROSS EASTERN AND CENTRAL NORTH AMERICA Ph.D. Thesis
Mark Donald Schwartz 1985 95 p
Avail: Univ. Microfilms Order No. DA8529151

Links among atmospheric processes and plant life stages are difficult to establish, because phenological data have been unavailable, and atmospheric mechanisms associated with life stage events are unclear. The annual onset of the spring season during the period is traced. Three hypotheses are tested with regression models that use 20 years of first leaf observations from cloned lilacs at 110 locations in eastern and central North America, thermal energy accumulation variables, daily solar radiational data, and 850 to 700 mb temperatures and winds. The first model was based on a theory that plant development is a smooth function driven by gradual changes in thermal and solar energy; it predicted first leaf dates with a mean absolute error of 8.0 days. A second model tested a hypothesis that certain synoptic events alone are responsible for phenological changes, and had a mean absolute error of 7.5 days. A third hypothesis was constructed from important parts of the first two. This theory assumed that synoptic systems are superimposed on a general

seasonal increase in thermal and solar energy. Other analyses showed that particular synoptic events occur at 5 to 7 day intervals before the phenological event, and that this relationship varies in phase across the study area. Dissert. Abstr.

N86-24079 Colorado Univ., Boulder.
A STUDY OF TROPICAL-EXTRATROPICAL INTERACTION ASSOCIATED WITH EQUATORIAL CONVECTION Ph.D. Thesis
George Nicholas Kiladis 1985 146 p
Avail: Univ. Microfilms Order No. DA8528498

Relationships between equatorial convection and synoptic scale features at 250 mb are examined on seasonal to daily time scales. Convection is defined on the basis of a satellite derived index of Highly Reflective Cloud (HRC), with circulation statistics based on National Meteorological Center tropical grid data. The seasonal position of maximum HRC is related to some extent to the state of the Southern Oscillation (SO). Anticyclonic flow anomalies occur poleward and slightly to the west of convection displaced to the east of normal over the equatorial Pacific, with equally strong cyclonic anomalies found with convection displaced to the west of normal. Other regions such as southern Asia and the mid-latitudes of the Pacific also show pronounced signals, in agreement with previous observational and modelling studies. Dissert. Abstr.

N86-24080 Florida State Univ., Tallahassee.
ON THE ASIAN MONSOON HEAT SOURCES AND ENERGETICS Ph.D. Thesis
Long-Chuan Quah 1985 226 p
Avail: Univ. Microfilms Order No. DA8528705

The Asian monsoon heat sources during the Northern Hemisphere winter and summer are evaluated by a physical approach using the GDFL FGGE III-b analyses supplemented by a mix of independent measurements. For the winter component, the analysis covers the entire period of FGGE SOP-1, and for the summer component, the analysis spans a 40-day period in the early summer of FGGE year. The evolution of monsoon heat sources and the salient regional characteristics of diabatic heating over several key monsoon subdomains are examined. The relationship between the diabatic heating and large-scale monsoon circulations are then studied from the principle of energy, within the framework of the energetics of rotational and divergent flows, and Lorentz's available potential energy formulation. The heat sources evaluated over the winter and summer MONEX domains are assessed by comparing the results with independent studies. This is followed by a detailed examination of the time mean and pentad (5-day mean) averaged vertically integrated heat sources over the analysis periods. Author

N86-24081 Deutscher Wetterdienst, Offenbach am Main (West Germany).
[ACTIVITIES REPORT IN METEOROLOGY IN WEST GERMANY] Annual Report, 1984 [JAHRESBERICHT 1984]
1985 90 p refs In GERMAN
(ISBN-3-88148-223-7; ISSN-0433-8251) Avail: Issuing Activity

The status of the German weather station networks is described. The activities of the weather forecasting service, the climatological service, the agrometeorological service, the aerological service, the radioactivity measurement service, the instrumental organization, the weather communication service, and the computer center are reported. Research activities of the German meteorological service are discussed. International cooperation is mentioned. Author (ESA)

N86-24082*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
CURRENT SCIENTIFIC ISSUES IN LARGE SCALE ATMOSPHERIC DYNAMICS
Timothy L. Miller, comp. Washington Jan. 1986 46 p refs Workshop held in Huntsville, Ala., 20-21 Jun. 1985
(NASA-CP-2410; M-506; NAS 55:2410) Avail: NTIS HC A03/MF A01

Topics in large scale atmospheric dynamics are discussed. Aspects of atmospheric blocking, the influence of transient baroclinic eddies on planetary-scale waves, cyclogenesis, the effects of orography on planetary scale flow, small scale frontal structure, and simulations of gravity waves in frontal zones are discussed. For individual titles, see N86-24083 through N86-24088.

N86-24083*# Virginia Univ., Charlottesville. Dept. of Environmental Sciences.
OBSERVED ASPECTS OF ATMOSPHERIC BLOCKING
Stephen J. Colucci *In* NASA. George C. Marshall Space Flight Center Crrent Scientific Issues in Large Scale Atmospheric Dynamics Jan. 1986 p 5-15 (For primary document see N86-24082 14-47)
Avail: NTIS HC A03/MF A01

An important problem in large-scale atmospheric dynamics is understanding the evolution of these blocking systems. Inspection of a large number of cases of 500 mb cyclonic and anticyclonic blocking vortices during recent winter seasons reveals that the occurrence of these systems is preceded by high amplitude (but not necessarily stationary) planetary waves at 500 mb and by intense synoptic-scale surface cyclone activity. A possible relationship between the cyclones and planetary waves during block evolution is thus hypothesized. Detailed diagnostic study of blocking cases during January 1977, February 1978 and November 1980 discloses that the development of 500 mb anticyclonic blocking vortices is preceded in time by the intense surface cyclogenesis between 500 mb planetary scale troughs and ridges, whereas blocking cyclonic vortices form following cyclogenesis near the axes of 500 mb troughs. A positive feedback between the cyclone and planetary waves is thus implied. The 500 mb height changes accompanying the above processes were analyzed in terms of quasi-geostrophic potential vorticity. During anticyclonic vortex development, there are spatially and temporally persistent calculated quasi-geostrophic height rises due to anticyclonic potential vorticity advections occurring near the cyclone track. Similarly, during cyclonic vortex development, there are spatially and temporally persistent calculated quasi-geostrophic height falls due to cyclonic potential vorticity advections occurring near the cyclone track. R.J.F.

N86-24084*# Miami Univ., Fla.
INFLUENCE OF TRANSIENT BAROCLINIC EDDIES ON PLANETARY-SCALE WAVES
Lee E. Branscome *In* NASA. George C. Marshall Space Flight Center Current Scientific Issues in Large Scale Atmospheric Dynamics Jan. 1986 p 17-22 refs (For primary document see N86-24082 14-47)
Avail: NTIS HC A03/MF A01

Low-order models with a mean zonal flow forced by zonally symmetric heating and one planetary-scale wave forced by topography have multiple flow equilibria. Two stable equilibria are characterized by strong zonal flow with low wave amplitude (high index circulation) and weak zonal flow with a high wave amplitude (low index circulation) fixed in phase with the topography. These two states presumably represent normal zonal circulation and a blocking configuration, respectively. When a shorter, baroclinically unstable wave is dded to this low-order model, the planetary-scale wave no longer stays in stable equilibrium states. Instead, the long wave remains in weather regimes or preferred regions in phase space. These regimes are, in general, different from the equilibria of the model with the planetary-scale wave only. Thus, the short unstable wave adds some randomness to planetary-scale circulation and changes its position with respect to the planetary-scale topography. The Reinhold and Pierrehumbert model is further explored here by adding a long-wave in the thermal forcing and exploring wider parameter space. When the symmetric thermal forcing is weak so that the short wave is stable, the planetary scale wave is fixed in amplitude and phase by the asymmetric forcing. However, when the symmetric forcing is increased to an unstable level, the planetary-scale wave becomes less organized. With asymmetric thermal forcing only (i.e., no topography) the long-wave is randomly distributed through phase space. Thermal

forcing seems to be less effective in organizing weather regimes than topographic forcing. R.J.F.

N86-24085*# Miami Univ., Fla.
CYCLOGENESIS
Rainer Bleck *In* NASA. George C. Marshall Space Flight Center Current Scientific Issues in Large Scale Atmospheric Dynamics Jan. 1986 p 23-24 refs (For primary document see N86-24082 14-47)
Avail: NTIS HC A03/MF A01

In order to extend the conventional baroclinic instability concept, one has to picture the growth process as resulting from the superposition of two neutrally stable baroclinic waves, an upper and a lower one, each wave propagating along a near-discontinuity in the potential vorticity (PV) field. The PV discontinuity for the lower wave is given by the non-uniformity of the thermal field at the ground, while the discontinuity for the upper wave is given by the contrast, in the 400 to 200 mb range, between the high-PV polar stratosphere and the low-PV subtropical troposphere. The horizontal PV radients mentioned are approximately opposed to each other, causing the wo waves to travel in the opposite direction. As Hoskins et al. (1985) show convincingly, a phase lock between the upper and lower wave may occur, coupled with a tendency toward mutual amplification. The conceptual model just outlined is particularly attractive to synoptic meteorologists because it does not require the two waves to be of initially small amplitude and thus does not fly in the face of observational evidence. This model, by allowing a finite perturbation velocity and a considerable range of relative phase speeds at the time when the upper and lower wave reach the proper phase lag for amplification, may lead to growth rates larger than those predicted by linear theory. R.J.F.

N86-24086*# Yale Univ., New Haven, Conn.
EFFECTS OF OROGRAPHY ON PLANETARY SCALE FLOW
Ronald B. Smith *In* NASA. George C. Marshall Space Flight Center Current Scientific Issues in Large Scale Atmospheric Dynamics Jan. 1986 p 25-27 (For primary document see N86-24082 14-47)
Avail: NTIS HC A03/MF A01

The earth's orography is composed of a wide variety of scales, each contributing to the spectrum of atmospheric motions. A well studied subject (originating with Charney and Eliassen) is the direct forcing of planetary scale waves by the planetary scale orography: primarily the Tibetan plateau and the Rockies. However, because of the non-linear terms in the equations of dynamic meteorology, even the smallest scales of mountain induced flow can contribute to the planetary scale if the amplitude of the small scale disturbance is sufficintly large. Two possible mechanisms for this are illustrated. First, preferentially located lee cyclones can force planetary waves by their meridional transport of heat and momentum (Hansen and Chen). Recent theories are helping to explain the phenomena of lee cyclogenesis (e.g., Smith, 1984, J.A.S.). Second, mesoscale mountain wave and severe downslope wind phenomena produce such a large local drag, that planetary scale waves can be produced. The mechanism of upscale transfer is easy to understand in this case as the standing planetary scale wave has a wavelength which depends on the mean structure of the atmosphere, and not on the width of the mountain (just as in small scale lee wave theory). An example of a theoretical description of a severe wind flow with very large drag is shown. R.J.F.

N86-24087*# National Center for Atmospheric Research, Boulder, Colo.
SMALL SCALE FRONTAL STRUCTURE: DYNAMICS OR DETAILS?
David B. Parsons *In* NASA. George C. Marshall Space Flight Center Current Scientific Issues in Large Scale Atmospheric Dynamics Jan. 1986 p 29-36 refs (For primary document see N86-24082 14-47)
Avail: NTIS HC A03/MF A01

Four topics concerning frontal circulations are discussed. The results of retrieving pressure and buoyancy perturbations from Doppler radar taken in an intense cold front, recent results on instabilities that occur along well detined frontal boundaries, the initiation of convection by frontal circulations, and the present crisis in the understanding of occluded frontal systems are discussed. R.J.F.

N86-24088*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SIMULATIONS OF GRAVITY WAVES IN FRONTAL ZONES
Robert Gall *In its* Current Scientific Issues in Large Scale Atmospheric Dynamics Jan. 1986 p 37-42 (For primary document see N86-24082 14-47)
Avail: NTIS HC A03/MF A01

Recent observations of frontal systems passing over the PROFS network in Colorado by Shapiro (1984) indicate the horizontal scale of some fronts can be on the order of a few kilometers or less. Motivated by Shapiros results, esearchers re-ran an earlier numerical simulation of frontogenesis by Williams (1972) (where a very simple stretching deformation forcing of a front is considered) using as high a resolution in both the vertical and horizontal as was possible. Highest resolution that we considered consisted of a grid with a vertical spacing of 32 meters and a horizontal spacing of 260 meters in the immediate vicinity of the surface front. The purpose was to examine development of the frontal structures as the scale of the front became very small. Two sources for banded structures in clouds were found: (1) in the stationary waves above the front and (2) in waves propagating upward from breaking waves under the front. R.J.F.

N86-24089*# Institute for Atmospheric Optics and Remote Sensing, Hampton, Va.
DEVELOPMENT OF A GLOBAL MODEL FOR ATMOSPHERIC BACKSCATTER AT CO2 WAVELENGTHS Final Report, 7 Dec. 1983 - 6 Apr. 1985
G. S. Kent, P. H. Wang, U. Farrukh, A. Deepak, and E. M. Patterson (Georgia Technology Research Inst., Atlanta) Washington NASA Feb. 1986 388 p refs
(Contract NAS8-35594)
(NASA-CR-3959; NAS 1.26:3959) Avail: NTIS HC A17/MF A01 CSCL 04B

The variation of the aerosol backscattering at 10.6 micrometers within the free troposphere was investigated and a model to describe this variation was developed. The analysis combines theoretical modeling with the results contained within three independent data sets. The data sets used were obtained by the SAGE I/SAM II satellite experiments, the GAMETAG flight series, and by direct backscatter measurements. The theoretical work includes use of a bimodal, two component aerosol model, and the study of the microphysical and associated optical changes occurring within an aerosol plume. A consistent picture is obtained that describes the variation of the aerosol backscattering function in the free troposphere with altitude, latitude, and season. E.A.K.

N86-24090*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
STATISTICAL ANALYSIS OF DIRECT-STRIKE LIGHTNING DATA (1980 TO 1982)
Larry D. Lee, George B. Finelli, Mitchel E. Thomas, and Felix L. Pitts Jan. 1984 30 p refs
(NASA-TP-2252; L-15686; NAS 1.60:2252) Avail: NTIS HC A03/MF A01 CSCL 04B

Electromagnetic measurements are being made during direct lightning strikes by NASA Langley Center using a specially instrumented F-106B aircraft. The research is to aid refinement, characterization, and understanding of the lightning-aircraft interaction process and the lightning hazards to aircraft. Statistical methods are applied to characterize some aspects of the lightning data obtained from 176 strikes to the aircraft. Specific attention is given to the problem of estimating the upper extreme quantiles of the distributions of peak-to-peak values for currents and rates of change in the magnetic and flux densities. A formal treatment via a general location-scale family of models allows the estimation

method to be adapted to the realized shapes the distributions. The shapes are examined by probability plotting methods. Author

N86-24091*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
THE 1982 DIRECT STRIKE LIGHTNING DATA
Mitchel E. Thomas and Felix L. Pitts Mar. 1983 491 p refs
(NASA-TM-84626; NAS 1.15:84626) Avail: NTIS HC A21/MF A01 CSCL 04B

Wideband waveforms data which were obtained during the 1982 direct-strike lightning tests utilizing the NASA F106-B aircraft specially instrumented for lightning electromagnetic measurements. The aircraft was operated in a thunderstorm environment to elicit strikes to the aircraft during this testing period. Electromagnetic field data were recorded to both attached lightning and free field excitation of the aircraft. E.A.K.

N86-24092# National Weather Service, Silver Spring, Md. Techniques Development Lab.
VERY SHORT RANGE STATISTICAL FORECASTING OF AUTOMATED WEATHER OBSERVATIONS Interim Report, Oct. 1984 - Sep. 1985
Robert G. Miller Mar. 1986 96 p refs
(Contract DTFA01-83-Y-20625)
(DOT/FAA/PM-86/10) Avail: NTIS HC A05/MF A01

A procedure was developed to provide weather forecasting guidance over the short period of 10, 20, 30, and 60 minutes. The procedure uses automated surface observation elements as predictors and predictands. The model is founded on Markov assumption and utilizes multivariate linear regression as the statistical operator. The construction of the Generalized Equivalent Markov (GEM) model is outlined and compared with other objective methods such as climatology and persistence. It is found that GEM succeeds in bettering persistence and does so uniformly over the six projection periods of 10, 20, 30, and 60 minutes. E.A.K.

N86-24093# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CURRENT TRENDS TOWARD THE IMPROVEMENT OF SCIENTIFIC INSTRUMENTS FOR WEATHER SATELLITE APPLICATION
K. Ya. Kondratyev 7 Nov. 1985 16 p Transl. into ENGLISH from Meteorologiya i Gidrologiya (USSR), no. 3, Mar. 1973 p 107-112
(AD-A161839; FTD-ID(RS)T-0728-85) Avail: NTIS HC A02/MF A01 CSCL 04/2

A survey is given of the major trends and results in the development of weather satellite instrumentation designed to resolve inverse problems on-board the spacecraft. The discussion focuses on spacecraft similar to the American TIROS-M and ITOS weather satellites. Author (GRA)

N86-24094# Argonne National Lab., Ill.
SURVEY AND EVALUATION OF FIELD DATA SUITABLE FOR SMOKE HAZARD MODEL EVALUATION Technical Report, 1984 - 1985
Anthony J. Policastro and William E. Dunn Sep. 1985 68 p Sponsored in part by Army Medical Engineering Research and Development Lab., Fort Detrick, Md. Prepared in cooperation with Illinois Univ., Urbana
(AD-A161880; ANL/ER-85-3) Avail: NTIS HC A04/MF A01 CSCL 04/2

A summary and critical evaluation of the existing data on the dispersion of military smokes is presented. Emphasis is placed on fog oil smokes in terms of the measurement of concentration, dosage, particle size distribution, and mass deposition rate. The suitability of the available data for evaluating atmospheric dispersion models for health and environmental impacts purposes is marginal. Several questions remain as to the adequacy of the sampling techniques used and the validity of some of the supporting meteorological data. The best of the existing data on fog oil smoke dispersion were acquired during the Smoke Week 3 and 4 experiments. GRA

N86-24095# OptiMetrics, Inc., Bedford, Mass.
PROBABILITY AND CONDITIONAL PROBABILITY OF CUMULATIVE CLOUD COVER FOR SELECTED STATIONS WORLDWIDE Final Report, Dec. 1983 - Jul. 1985
William O. Gallery, John R. Hummel, and David A. Farmer Jul. 1985 229 p
(Contract F19628-84-C-0049)
(AD-A162210; OMI-139; AFGL-TR-85-0154) Avail: NTIS HC A11/MF A01 CSCL 04/2

Cloud cover has a major impact on both visible and infrared electro-optical sensors. Climatological statistics of the probability of cloud cover would be useful to tactical commanders planning missions over hostile or contested territory where observations are unavailable. This report presents tables of the historical probability, by okta, of cumulative cloud cover at or below 15 given altitudes. The data consist of routine surface weather observations from the ETAC DATSAV database. Out of 41 stations considered from four regions (Germany, Korea, the Middle East, and Central America), 29 stations had data suitable for analysis. Analyses performed for each station were broken down by season and time of day (0000 to 0559, 0600 to 1159, 1200 to 1759, and 1800 to 2359 local time), then averaged separately over season and over time of day, and over all seasons and times of day. Graphical and tabular results are presented for all stations for the average over all seasons and time of day; and for a selected station (Bitburg, West Germany) averages by season and time of day are given. The full set of tables is available on tape. Another goal is to answer the question: suppose that a remote measurement indicates that a cloud is or is not present at or below a given altitude, how much additional information does this measurement add to the historical probabilities--i.e., how much different are the conditional probabilities of cumulative cloud cover given that a cloud is or is not reported compared to the unconditional (historical) probabilities? Tables of these conditional probabilities are presented. GRA

N86-24096# Atmospheric and Environmental Research, Inc., Cambridge, Mass.
MILLIMETER WAVE MOISTURE SOUNDER FEASIBILITY STUDY: THE EFFECT OF CLOUD AND PRECIPITATION ON MOISTURE RETRIEVALS Final Report, 8 Aug. 1984 - 7 Feb. 1985
R. G. Isaacs, G. Deblonde, R. D. Worsham, and M. Livshits 8 Mar. 1985 46 p
(Contract F19628-84-C-0134)
(AD-A162231; P110F; AFGL-TR-85-0040) Avail: NTIS HC A03/MF A01 CSCL 04/2

A simulation model applicable to the design specification of a millimeter wave moisture sounder is described. The algorithm is capable of treating the response of a multifrequency radiometer to realistic variations in vertical profiles of atmospheric temperature and moisture, surface emissivity, cloud and precipitation. Analyses were performed to investigate the sensitivity of proposed moisture sounder channels to changes in the vertical distribution of atmospheric water vapor and the presence of cloud and rain. Preliminary studies based on statistical inversion methods demonstrate moisture retrieval capabilities in clear, cloudy, and precipitating cases. Results indicate that cloud and precipitation will most likely degrade moisture sounder performance. Investigation of moisture retrieval methodologies which explicitly treat cloud effects is recommended. GRA

N86-24097# Naval Postgraduate School, Monterey, Calif.
A DIAGNOSTIC STUDY OF BAROCLINIC DISTURBANCES IN POLAR AIR STREAMS Ph.D. Thesis
Mark R. Sinclair Sep. 1985 194 p
(AD-A162254) Avail: NTIS HC A09/MF A01 CSCL 04/2

Model-generated data and FGGE analyses are used to calculate quasi-Lagrangian budgets of mass, vorticity, heat and moisture following disturbances that form within polar air streams.

These polar lows grow primarily through basic baroclinic instability processes and exhibit many features of larger maritime extratropical cyclones. Polar lows that originate on the equatorward side of a nearly straight upper-level jet are contrasted with lows that form on the poleward side of the jet and have considerable midtropospheric positive vorticity advection at formation time. The absence of favorable coupling to a jet stream was the missing factor in two model-generated polar lows that failed to develop. Although the vorticity balance is initially different for the two types of polar lows, the vorticity budgets during later stages are similar. The heat budget and the thickness tendency equation demonstrate that the self-development process that is present in larger maritime cyclones is also important for polar low intensification.

Author (GRA)

N86-24098# Naval Postgraduate School, Monterey, Calif.
UTILIZATION OF SATELLITE-OBSERVED CLOUD PATTERNS TO IMPROVE ANALYSES OF EXPLOSIVE EXTRATROPICAL MARITIME CYCLOGENESIS M.S. Thesis
Dock David Williams, Jr. Sep. 1985 87 p
(AD-A162306) Avail: NTIS HC A05/MF A01 CSCL 04/2

On the basis of analysis of satellite imagery, a set of designated cloud patterns is explored to evaluate their potential for improving the forecasts of explosively deepening extratropical cyclones. An analysis of 23 western Atlantic Ocean cases included correlation of infrared satellite imagery with derived pressure diagrams and synoptic data. The study includes: (1) quantitative pattern definition, (2) frequency of occurrence statistics and (3) objective evaluations of usage potential. Specific findings include: (1) a high number of dual cloud element storms; (2) distinct developmental segments in pressure fall rates of the storms; (3) varying degrees of reliability for the designated cloud patterns and (4) discussion of the practicability of formulating a storm developmental analog from the designated cloud patterns. GRA

N86-24099# Gould, Inc., Middletown, R.I. Ocean Defense Div.
THE TURBULENT GRAVITY WAVE-CRITICAL LEVEL ENCOUNTER IN THE EVOLUTION OF ATMOSPHERIC FLOW Final Report
John R. Grant Jun. 1985 32 p
(Contract F49620-84-C-0048)
(AD-A162335; OSD-771-HYDRO-CR-85-03; AFOSR-85-1006TR) Avail: NTIS HC A03/MF A01 CSCL 04/1

The extended objective of this work is to contribute to understanding the short term response of the atmosphere to short term influences. The particular influence studied is internal gravity wave motion, specifically the encounter of a gravity wave with a critical level, a height where the component of the wind speed in the direction of the horizontal phase propagation matches the horizontal component of wave phase speed. Two major effects of such encounters are the deposition in the wind of momentum transported by the wave motion and the generation of turbulence by the wave motion. Both phenomena modify the wind in the vicinity of the critical level. Several nonturbulent and turbulent calculations of a gravity wave-critical level encounter were performed. The simulated signatures will aid in the examination of interpretation of the records of the Poker Flats and Sunset Doppler radars. Of those events which can be identified as critical level encounters, one or two will be selected for numerical simulation, for which key parameters are matched to those extracted from the observations. GRA

N86-24100# Air Force Geophysics Lab., Hanscom AFB, Mass.
STORM PRECIPITATION AND WIND STRUCTURE DURING AIRCRAFT STRIKE LIGHTNING EVENTS Environmental Research Papers
Alan R. Bohne and Albert C. Chmela 24 May 1985 38 p
(AD-A162338; AFGL-TR-85-0121; AFGL-ERP-917) Avail: NTIS HC A03/MF A01 CSCL 04/1

A limited set of in situ aircraft and ground-based radar data acquired during the 1981 and 1982 Joint Agency Turbulence Experiment are used to study the relationship of aircraft lightning strikes to storm precipitation, turbulence severity, and wind shear. The strikes are found to be strongly correlated with vertical drafts, predominantly downdrafts. The strikes were also well correlated with regions of strong turbulence. However, since most strong turbulence episodes were not associated with lightning, use of lightning location methods to locate hazardous turbulence within storms is considered unreliable. The strikes occurred in storm regions having radar reflectivity factor between 25 to 35 dBZ. These regions were generally on the boundaries of the dominant storm precipitation cores. Storm wind shear was frequently high in regions near aircraft strikes. The strong correlations with strong turbulence, downdraft boundaries, and precipitation core boundaries suggest that the strikes occurred in regions of charge separation. GRA

N86-24101# Naval Environmental Prediction Research Facility, Monterey, Calif.
DESIGN CONSIDERATIONS FOR AN ADVANCED TROPICAL CYCLONE MODEL Final Report, 3-4 Jan. 1985
Russell L. Elsberry and Michael Fiorino Oct. 1985 151 p
(AD-A162813; NEPRF-TR-85-03) Avail: NTIS HC A08/MF A01 CSCL 04/2

A project planning meeting on dynamical tropical cyclone models was held January 3 to 4 1985 at NAVENVPREDRSCHFAC to guide development of a next-generation forecast model, or Advanced Tropical Cyclone Model (ATCM). The meeting was structured in three groups: an Operational group (OP) to provide forecaster needs and real world constraints; a Numerical Aspects group (NUM) with expertise in the numerical modeling issues; and a Data Analysis and Initialization group (DAI) to guide the development of the data analysis and initialization component of ATCM. GRA

N86-24102# Air Force Systems Command, Patrick AFB, Fla.
METEOROLOGICAL RANGE SUPPORT REQUIREMENTS AND IMPLICATIONS FOR THE FUTURE OF SHUTTLE OPERATIONS Progress Report, 1984 - 1985
Edward F. Kolczynski, Thomas M. Myers, and Billie F. Boyd 1985 14 p Previously announced in IAA as A86-19687
(AD-A162877; ESMC-TR-85-05) Avail: NTIS HC A02/MF A01 CSCL 04/2

The addition of a landing facility at the Kennedy Space Center (KSC) and an increased launch rate for the space shuttle required a significant change in meteorological requirements. The joint USAF-NASA efforts for improved support are discussed, including past efforts and future plans. Meteorological constraints to Shuttle operations are presented, forecasting benefits of the various systems are reviewed and weather impacts on specific missions are discussed. GRA

N86-24103# Air Force Systems Command, Patrick AFB, Fla.
INTERACTIVE INFORMATION AND PROCESSING SYSTEMS USED FOR METEOROLOGICAL SUPPORT TO THE EASTERN TEST RANGE Progress Report, 1984 - 1985
Billie F. Boyd and Thomas M. Myers 1985 17 p
(AD-A162878; ESMC-TR-85-06) Avail: NTIS HC A02/MF A01 CSCL 04/2

The report details various interactive meteorological systems in use at the Cape Canaveral Forecast Facility (CCFF) to support the space shuttle and missile launch operations at the Eastern Test Range (ETR). Weather requirements are discussed and data input/output described. GRA

N86-24104# Air Force Systems Command, Patrick AFB, Fla.
LIGHTNING AT KENNEDY SPACE CENTER Progress Report, 1984 - 1985
William C. Gibbons, Billie F. Boyd, and William Jafferis 1985 10 p
(AD-A162947; ESMC/TR-85-07) Avail: NTIS HC A02/MF A01 CSCL 04/2

The Kennedy Space Center/Cape Canaveral Air Force Station (KSC/CCAFS) area borders the area of highest frequency of thunderstorms in the United States. Since the majority of the thunderstorms occur in the summer months, lightning frequencies

in the area during these months approach the highest level of any location in the world. This high level of frequency presents three major problems: danger to personnel damage to equipment and property and loss of time in order to minimize the previous items. Two major lightning detection systems currently in use in the KBC/CCAFS area are the Launch Pad Lightning Warning System (LPLWS) and the Lightning Location and Protection (LLP) system. Lightning activity in the KSC/CCAFS area is both a curse and a blessing. The high lightning frequency is a threat to life and slows space vehicle operations. Yet, the presence of numerous lightning strikes as well as sophisticated lightning detection systems make KSC an ideal location for lightning research to perfect lightning detection and protection. GRA

N86-24105# Control Data Corp., Minneapolis, Minn. Meteorology Research Center.
THE INTERACTION AND VARIATION OF WAVES AND TURBULENCE FROM MST RADAR DATA Final Report, 1 Feb. 1982 - 30 Sep. 1985
G. D. Nastrom 27 Nov. 1985 11 p
(Contract F49620-82-C-0029)
(AD-A162983; AFOSR-85-1138TR) Avail: NTIS HC A02/MF A01 CSCL 17/9

This report summarizes research results obtained using data from clear-air Doppler radars in Alaska, Colorado, and France. Among other variables, these radars measure the vertical velocity over the height range from about three to twenty kilometers. A brief climatology of the variability of vertical velocity was prepared, including a study of its relationship to synoptic weather events. Comparisons of the time-averaged vertical velocity to estimates of the vertical velocity computed from the equations of motion and routine meteorological data showed that these radars provide a measure of the sub-synoptic scale vertical velocity of the atmosphere, at least under certain conditions. Details of the echoing mechanism for vertically directed antenna systems were studied to help interpret the measurements. Another variable provided by MST radars is the backscattered echo power, which is directly related to the refractivity turbulence structure constant (C-sub-n-squared) when the antenna beam is not directed vertically. GRA

N86-24106# Virginia Univ., Charlottesville. Dept. of Environmental Sciences.
CYCLONE TRACKS AND WAVE CLIMATES AT CAPE HATTERAS, NORTH CAROLINA
Richard A. Wayland and Bruce P. Hayden Aug. 1985 73 p
(Contract N00014-81-K-0033)
(AD-A162999; TR-31) Avail: NTIS HC A04/MF A01 CSCL 04/2

The tracks of individual tropical and extratropical cyclones are an important determinant of the magnitude and duration of the water waves that will be produced along the mid-Atlantic coast. Based on a data set covering the years 1942 to 1984, an eastward displacement in the mean track of extratropical cyclones associated with increasing wave magnitude and duration is evident. Tropical cyclones show a westward shift in the mean track with increasing wave magnitude, but little change with duration. No temporal pattern could be identified in the frequency of extratropical storms while the number of tropical cyclones has declined over the past fifteen years. The relationship between sea-surface temperatures, the Gulf Stream, and upper latitude blocking and cyclone movement is briefly discussed as possible reasons for the changes in the mean storm tracks. GRA

N86-24107# Los Alamos National Lab., N. Mex.
SUMMARY OF MATHEW/ADPIC MODEL EVALUATION STUDIES
M. H. Dickerson Oct. 1985 13 p refs Presented at the International Symposium on Emergency Planning and Preparedness for Nuclear Facilities, Rome, Italy, 4 Nov. 1985
(Contract W-7405-eng-48)
(DE86-002139; UCRL-92319; CONF-851117-2) Avail: NTIS HC A02/MF A01

This report summarizes model evaluation studies conducted for the MATHEW/ADPIC transport and diffusion models during the past ten years. These models support the US Department of Energy Atmospheric Release Advisory Capability, an emergency response service for atmospheric releases of nuclear material. Field campaigns involving tracer releases used in these studies cover a broad range of meteorology, terrain and tracer release heights, the three most important aspects of estimating air concentration values resulting from airborne releases of toxic material. Results of these studies show that these models can estimate air concentration values within a factor of 2, 20% to 50% of the time and a factor of 5, 40% to 80% of the time. As the meteorology and terrain become more complex and the release height of the tracer is increased the accuracy of the model calculations degrades. This band of uncertainty appears to correctly represent the capability of these models at this time. DOE

N86-24108# Los Alamos National Lab., N. Mex.
ATMOSPHERIC PERTURBATIONS OF LARGE-SCALE NUCLEAR WAR
R. C. Malone 1985 23 p refs Presented at the Symposium on the Medical Implications of Nuclear War, Washington, D.C., 20 Sep. 1985
(Contract W-7405-eng-36)
(DE86-002410; LA-UR-85-3671; CONF-8509194-1) Avail: NTIS HC A02/MF A01

Computer simulation of the injection into the atmosphere of a large quantity of smoke following a nuclear war are described. The focus is on what might happen to the smoke after it enters the atmosphere and what changes, or perturbations, could be induced in the atmospheric structure and circulation by the pressure of a large quantity of smoke. DOE

N86-24109# Argonne National Lab., Ill.
INVESTIGATIONS OF THE CONVECTIVE PLANETARY BOUNDARY LAYER USING A MULTIPLE FREQUENCY SODAR
R. L. Coulter and T. J. Martin 1985 15 p refs Presented at the 3rd International Symposium on Acoustic Remote Sensing of the Atmosphere and Oceans, Paris, France, 14 Oct. 1985
(Contract W-31-109-eng-38)
(DE86-003040; CONF-8510214-1) Avail: NTIS HC A02/MF A01

The multifrequency, bistatic sodar system currently in operation at Argonne National Laboratory is described. Estimates of horizontal convergence within thermal plumes show good consistency between horizontal and vertical wind fields. Values of convergence associated with thermal plumes near 0.001 s(-1) were observed, when a circularly symmetric model for the deviation from the mean horizontal and vertical wind fields is assumed. DOE

N86-24110# National Weather Service, Fort Worth, Tex.
AFOS (AUTOMATION OF FIELD OPERATIONS AND SERVICES) DATA ANALYSIS PROGRAMS
P. D. Bothwell Oct. 1985 81 p
(PB86-123759; NOAA-TM-NWS-SR-114) Avail: NTIS HC A05/MF A01 CSCL 04B

AFOS (Automation of Field Operations and Services) Data Analysis Programs have been designed to maximize the information available from conventional surface and upper-air data. GRA

N86-24111# National Weather Service, Honolulu, Hawaii.
SKYWARN-HAWAII
M. J. Morrow Dec. 1984 12 p
(PB86-107505; NOAA-NWSTM-PR-28) Avail: NTIS HC A02/MF A01 CSCL 04B

The operation of the Oahu/Statewide SKYWARN Net is clarified the setup as it presently exists (December 1984) is described. In general, Hawaiian weather is benign, but on occasion a hurricane or severe winter storm may create a problem. It is at these times that the SKYWARN Net is called into service. GRA

N86-24112# National Oceanic and Atmospheric Administration, Seattle, Wash. Marine Environmental Lab.
RELATIONSHIPS BETWEEN SURFACE OBSERVATIONS OVER

THE GLOBAL OCEANS AND THE SOUTHERN OSCILLATION
P. B. Wright, T. P. Mitchell, and J. M. Wallace Jan. 1985 70 p Prepared in cooperation with Washington Univ., Seattle
(PB86-110038; NOAA-DR-ERL-PMEL-12) Avail: NTIS HC A04/MF A01 CSCL 04B

The atlas contains maps of correlation and regression coefficients between seasonal anomalies of surface meteorological fields over the global oceans and Darwin, Australia annual-mean sea-level pressure anomalies. The statistics were calculated for six consecutive seasons defined relative to the Darwin index. The resulting charts provide a description of the time evolution of meteorological anomalies associated with the Southern Oscillation over the global oceans. GRA

N86-24113# National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Sciences Group.
SUB-SYNOPTIC WEATHER ANALYSIS AND THE FORECASTING OF CONVECTIVE WEATHER EVENTS IN THE SOUTHEASTERN UNITED STATES
C. A. Liles Mar. 1985 158 p
(PB86-110228; NOAA-TM-ERL-ESG-17) Avail: NTIS HC A08/MF A01 CSCL 04B

Conventionally analyzed surface and upper-air data are reanalyzed, employing sub-synoptic analysis and enhancement techniques and discussed in detail. The potential of these procedures for improving short-range weather forecasts is shown through numerous examples that compare conventional and sub-synoptic analysis techniques. Sub-synoptic analysis has been an integral part of the forecasting routine for several years. The Technical Memorandum is not a complete answer to operational problems posed by significant convective storms, but the case studies considered substantiate the value of intensive analysis procedures. Author (GRA)

N86-24114# National Weather Service, Silver Spring, Md. Office of Hydrology.
PROBABLE MAXIMUM PRECIPITATION ESTIMATES FOR DRAINAGE ABOVE DEWEY DAM, JOHNS CREEK, KENTUCKY
D. D. Fenn Aug. 1985 42 p Sponsored in part by Soil Conservation Service, Portland, Oreg.
(PB86-111333; NOAA-TM-NWS-HYDRO-41) Avail: NTIS HC A03/MF A01 CSCL 04B

Estimates of probable maximum precipitation (Pmp) for the drainage of Johns Creek, Kentucky above Dewey Dam are discussed. Estimates are given for durations from 1 to 72 hr for the drainage. Part of the procedure used to evaluate terrain effects required selection of proxy observations of precipitation since there were no reporting locations within the drainage. The total PMP estimates are the products of the drainage average depth of nonorographic PMP and the orographic intensification factor representing the evaluation of terrain effects within the drainage. GRA

N86-24115# National Center for Atmospheric Research, Boulder, Colo.
APPLICATIONS OF A NEW VERIFICATION METHODOLOGY FOR REGIONAL-SCALE NUMERICAL MODELS M.S. Thesis
P. A. Stamus 1985 163 p Sponsored in part by National Science Foundation, Washington, D.C. Prepared in cooperation with Oklahoma Univ., Norman
(PB86-111317; NCAR/CT-94) Avail: NTIS HC A08/MF A01 CSCL 04B

A verification methodology was developed for regional models using a combination of traditional statistical scores and scale separation on both primary and derived variables. The scale separation was performed using the Errico technique (Errico, 1985). This methodology was applied to two numverical models--the Operational Limited-Area Fine-Mesh Model (LFM-II) and the Anthes/Warner NCAR/PSU Mesoscale Model (MM3). Verification was performed on both the initial analyses and the model forecasts for three cases. Author (GRA)

N86-24116# National Weather Service, Washington, D.C. Climate Analysis Center.
MONTHLY AND SEASONAL WEATHER OUTLOOK FOR OCTOBER 1984, VOLUME 39, NUMBER 19, SEPTEMBER 28, 1985
Sep. 1985 10 p
(PB86-112703) Avail: NTIS HC A02/MF A01 CSCL 04B

Monthly and seasonal weather outlooks for North America are presented. GRA

N86-24117# National Weather Service, Salt Lake City, Utah.
OBJECTIVE CONTOUR ANALYSIS USING THE SURFACE OF LEAST BENDING (SPLINE ANALYSIS)
L. Colin Nov. 1985 44 p
(PB86-128675; NOAA-NWS-WRCP-52) Avail: NTIS HC A03/MF A01 CSCL 04B

Objective height and vorticity contour analysis is done on upper air plot data over a limited geographical region by fitting a surface of least elastic bending to the data. All height and wind data are fit exactly, as implied by the second law of thermodynamics. The least bending surface has the greatest probability of reconstructing the original field from the given data points. The program was written to provide the most accurate reconstruction possible of the original fields which generated the height and wind data. A barotropic forecast model derived from spline analysis is written. GRA

N86-24118# Texas A&M Univ., College Station. Sea Grant College Program.
HURRICANE RELOCATION PLANNING FOR CAMERON AND WILLACY COUNTIES
C. Ruch Sep. 1985 156 p Sponsored in part by NOAA, Rockville, Md. and Texas Governor's Div. of Emergency Management, Austin
(Contract NA83AA-D-00061)
(PB86-127594; TAMU-SG-86-601) Avail: NTIS HC A08/MF A01 CSCL 04B

The Governor's Division of Emergency Management has been active in preparing coastal areas for the impact of hurricanes. Three studies are anticipated for each coastal area--a relocation/evacuation study; a vulnerability analysis study; and a contingency planning study. All three studies have been completed for the Houston-Galveston and the Corpus Christi areas. Relocation/evacuation and vulnerability analysis studies are complete for the Lake Sabine area and this report represents the first study for the Brownsville area. GRA

N86-24119# National Weather Service, Washington, D.C. Climate Analysis Center.
MONTHLY AND SEASONAL WEATHER OUTLOOK FOR DECEMBER 1985, VOLUME 39, NUMBER 23, NOVEMBER 28, 1985
28 Nov. 1985 10 p
(PB86-131802) Avail: NTIS HC A02/MF A01 CSCL 04B

Temperature and precipitation probabilities for the Northern Hemisphere on a periodic and seasonal basis are reported. GRA

N86-24120*# National Academy of Sciences - National Research Council, Washington, D. C. Commission on Physical Sciences, Mathematics and Resources.
PROCEEDINGS OF THE FIRST NATIONAL WORKSHOP ON THE GLOBAL WEATHER EXPERIMENT: CURRENT ACHIEVEMENTS AND FUTURE DIRECTIONS, VOLUME 1 Final Report
Oct. 1985 89 p refs Workshop held in Woods Hole, Mass., 9-20 Jul. 1984
(Grant NSF ATM-80-25329)
(NASA-CR-176720; NAS 1.26:176720) Avail: NTIS HC A05/MF A01 CSCL 04B

A summary of the proceedings in which the most important findings stemming from the Global Weather Experiment (GWE) are highlighted, additional key results and recommendations are comered, and the presentations and discussion are summarized. Detailed achievements, unresolved problems, and recommendations are included. Author

N86-24121*# National Academy of Sciences - National Research Council, Washington, D. C. Commission on Physical Sciences, Mathematics, and Resources.
PROCEEDINGS OF THE FIRST NATIONAL WORKSHOP ON THE GLOBAL WEATHER EXPERIMENT: CURRENT ACHIEVEMENTS AND FUTURE DIRECTIONS, VOLUME 2, PART 1 Final Report
Oct. 1985 384 p refs Workshop held in Woods Hole, Mass., 9-20 Jul. 1984 Sponsored in cooperation with NASA and NOAA 3 Vol.
(Grant NSF ATM-80-25329)
(NASA-CR-176721; NAS 1.26:176721; PB86-139169) Avail: NTIS HC A17/MF A01 CSCL 04B

Topics covered include: data systems and quality; analysis and assimilation techniques; impacts on forecasts; tropical forecasts; analysis intercomparisons; improvements in predictability; and heat sources and sinks. For individual titles, see N86-24122 through N86-24141.

N86-24122*# Wisconsin Univ., Madison.
SATELLITE OBSERVED THERMODYNAMICS DURING FGGE
William L. Smith *In* NAS-NRC Proceedings of the First National Workshop on the Global Weather Experiment, Vol. 2, Pt. 1 Oct. 1985 p 3-18 refs (For primary document see N86-24121 14-47)
Avail: NTIS HC A17/MF A01 CSCL 04B

During the First Global Atmospheric Research Program (GARP) Global Experiment (FGGE), determinations of temperature and moisture were made from TIROS-N and NOAA-6 satellite infrared and microwave sounding radiance measurements. The data were processed by two methods differing principally in their horizontal resolution. At the National Earth Satellite Service (NESS) in Washington, D.C., the data were produced operationally with a horizontal resolution of 250 km for inclusion in the FGGE Level IIb data sets for application to large-scale numerical analysis and prediction models. High horizontal resolution (75 km) sounding data sets were produced using man-machine interactive methods for the special observing periods of FGGE at the NASA/Goddard Space Flight Center and archived as supplementary Level IIb. The procedures used for sounding retrieval and the characteristics and quality of these thermodynamic observations are given.
Author

N86-24123*# National Meteorological Center, Camp Springs, Md.
CLOUD-DRIFT WIND ESTIMATES DURING PGGE
Ronald D. McPherson *In* NAS-NRC Proceedings of the First National Workshop on the Global Weather Experiment, Vol. 2, Pt. 1 Oct. 1985 p 19-36 refs (For primary document see N86-24121 14-47)
Avail: NTIS HC A17/MF A01 CSCL 04B

Cloud drift winds constitute an important component of the First Global Atmospheric Research Program Experiment data base. Data was generated by far different centers, using somewhat different procedures. Image data transformation to wind vectors is discussed. Emphasis is placed on the differences between the processing techniques employed in each system. The use of cloud drift data by global data assimulation systems is reviewed, including quality control and relative weighting.
B.G.

N86-24124*# National Oceanic and Atmospheric Administration, Rockville, Md. Office of Climatic and Atmospheric Research.
BUOY SYSTEMS DURING THE PGGE
Rex J. Fleming *In* NAS-NRC Proceedings of the First National Workshop on the Global Weather Experiment, Vol. 2, Pt. 1 Oct. 1985 p 37-50 refs (For primary document see N86-24121 14-47)
Avail: NTIS HC A17/MF A01 CSCL 04B

The data quality, impact, and application of various buoy systems deployed during the FGGE are discussed. Three general categories of buoy systems provided critical coverage of environmental phenomena in the Arctic Ocean basin, the tropical oceans, and the Southern Hemisphere. Results of the added pressure information in the Arctic are presented. The impacts of the Southern Hemisphere buoy systems on pressure fields, SST fields, and ocean circulation are provided. Those findings from the tropical drifters, relevant to the FGGE time scales, are indicated. All three types of buoy systems, each uniquely engineered for application in different regions of our planet, contributed to the broad objective of advancing weather and climate predictions in several special ways. Comments are provided about the role of buoys in a future observing system, and a consortium of interested countries is strongly advocated in order to accelerate this role.
Author

N86-24125*# Dalhousie Univ., Halifax (Nova Scotia). Dept. of Mathematics.
THE TROPICAL SPECIAL OBSERVING SYSTEM
Paul R. Julian *In* NAS-NRC Proceedings of the First National Workshop on the Global Weather Experiment, Vol. 2, Pt. 1 Oct. 1985 p 51-68 refs Prepared in cooperation with National Center for Atmospheric Center, Boulder, Colo. (For primary document see N86-24121 14-47)
Avail: NTIS HC A17/MF A01 CSCL 04B

The performance summaries of the components of the Tropical Observing System is covered. Some of the more important points concerning the quality of the data from each of the observing systems is emphasized, and examples of the assimilation of the Level IIb data are shown.
Author

N86-24126*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OBJECTIVE ANALYSIS AND ASSIMILATION TECHNIQUES USED FOR THE PRODUCTION OF FGGE 3b ANALYSES
Roger W. Daley (National Center for Atmospheric Research, Boulder, Colo.), Anthony Hollingsworth (European Center for Medium Range Weather Forecasts, Reading, England), Jeffrey J. Ploshay (Princeton Univ., N.J.), Kikuro Miyakoda (Princeton Univ., N.J.), Wayman E. Baker, Eugenia Kalnay, C. Dey (National Meteorological Center, Camp Springs, Md.), T. N. Krishnamurti (Florida State Univ., Tallahasee), and E. Barker (Naval Environmental Prediction Research Facility, Monterey, Calif.) *In* NAS-NRC Proceedings of the First National Workshop on the Global Weather Experiment, Vol. 2, Pt. 1 Oct. 1985 p 71-82 (For primary document see N86-24121 14-47)
Avail: NTIS HC A17/MF A01 CSCL 04B

A system of seven tables, which cover analysis archiving, observation types, quality control, data assimilation cycles, assimilating models, initialization, and analysis techniques was adopted. The set of prepared tables allows side-by-side comparison of the characteristics of the six data assimilation systems (European Center for Medium Range Weather Forecasts, Geophysical Fluid Dynamics Laboratory, Goddard Laboratory for Atmospheric Science, National Meteorological Center, Florida State University, and Naval Environmental Prediction Research Facility) used to produce FGGE IIIb analyses.
Author

N86-24127*# European Centre for Medium-Range Weather Forecasts, Reading (England).
RESULTS FROM TWO RECENT OVSERVING SYSTEM EXPERIMENTS
S. Uppala, P. Kallberg, Anthony Hollingsworth, and S. Tibaldi *In* NAS-NRC Proceedings of the First National Workshop on the Global Weather Experiment, Vol. 2, Pt. 1 Oct. 1985 p 85-118 refs (For primary document see N86-24121 14-47)
Avail: NTIS HC A17/MF A01 CSCL 04B

Two Observing System Experiments were carried out at (ECMWF). The European Center for Medium Range Weather Forecasting impact of various observing systems were examined for two periods during the EGGE year: November 8 to 9, 1979 (OSE-1) and February 22 to March 7, 1979 (OSE-II). Attempts were made to understand the effect of the observing systems on both the analyses and the quality of the short and medium range forecasts. The results confirm that the impact of a particular observing system (e.g., SATEM) is dependent on the level of synoptic activity present in the areas where this particular observing system is the main soruce of meteorological information. SATOB data are also shown to be improtant for the analyses of tropical regions, whereas SATEM data are of paramount importance for the extratropical analyses over ocean areas. Aircraft data, where available, are an invaluable addition to the global observational

data base. These results therefore demonstrate clearly the value of each of the observing systems. The fact that, in particular circumstances, there may be some redundancy between the systems is a strength rather than a weakness of the composite global observing system. Author

N86-24128*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GLAS EXPERIMENTS ON THE IMPACT OF FGGE SATELLITE DATA ON NUMERICAL WEATHER PREDICTION
Eugenia Kalnay, R. Atlas, Wayman E. Baker, and Joel Susskind *In* NAS-NRC Proceedings of the First National Workshop on the Global Weather Experiment, Vol. 2, Pt. 1 Oct. 1985 p 121-145 refs (For primary document see N86-24121 14-47)
Avail: NTIS HC A17/MF A01 CSCL 04B

Simulation studies and pre-FGGE data impact studies were briefly reviewed. Impact of Goddard Laboratory for Atmospheric Science temperature soundings and cloud tracked winds was also examined. B.G.

N86-24129*# Australian Numerical Meteorology Research Center, Melbourne.
THE IMPACT OF THE FGGE OBSERVING SYSTEMS IN THE SOUTHERN HEMISPHERE
Kamal Puri, W. Boourke, and R. Seaman *In* NAS-NRC Proceedings of the First National Workshop on the Global Weather Experiments, Vol. 2, Pt. 1 Oct. 1985 p 146-160 refs (For primary document see N86-24121 14-47)
Avail: NTIS HC A17/MF A01 CSCL 04B

Results of studies carried out at the Australian Numerical Meteorology Research Centre (ANMRC) and the Australian Bureau of Meteorology to assess the impact of FGGE on numerical weather prediction in the Southern Hemisphere are presented. These studies inducate that the FGGE data base had a significant impact on analysis and numerical weather prediction. From the operational standpoint, the most outstanding contribution was made by the drifting buoy data that enabled reliable routine surface pressure analyses to be made over the entire hemisphere. The results of a limited study using the MNMRC data assimilation scheme show that the quality of prediction to 48 hours hinges crucially on both the buoy pressure data and satellite temperature soundings with single level satellite winds having a small impact. Author

N86-24130*# Florida State Univ., Tallahassee. Dept. of Meteorology.
NUMERICAL WEATHER PREDICTION IN LOW LATITUDES
T. N. Krishnamurti *In* NAS-NRC Proceedings of the First National Workshop on the Global Weather Experiment, Vol. 2, Pt. 1 Oct. 1985 p 163-187 refs (For primary document see N86-24121 14-47)
Avail: NTIS HC A17/MF A01 CSCL 04B

Based on the results of a number of numerical prediction experiments, the differential heating between land and ocean is an important and critical factor for investigation of phenomenon such as the onset of monsoons over the Indian subcontinent. The pre-onset period during the month of May shows a rather persistent flow field in the monsoon region. At low levels the circulation exhibits anticyclonic excursions over the Arabian Sea, flowing essentially parallel to the west coast of India from the north. Over the Indian subcontinent the major feature is a shallow heat low over northern India. As the heat sources commence a rapid northwestward movement toward the southern edge of the Tibetan Plateau, an interesting configuration of the large-scale divergent circulation occurs. A favorable configuration for a rapid exchange of energy from the divergent to the rotational kinetic energy develops. Strong low level monsoonal circulations evolve, attendant with that the onset of monsoon rains occurs. In order to test this observational sequence, a series of short-range numerical prediction experiments were initiated to define the initial heat sources. Author

N86-24131*# European Centre for Medium-Range Weather Forecasts, Reading (England).
ON THE IMPACT OF THE FGGE ON TROPICAL FORECASTS
William A. Heckley *In* NAS-NRC Proceedings of the First National Workshop on the Global Weather Experiment, Vol. 2, Pt. 1 Oct. 1985 p 188-208 refs (For primary document see N86-24121 14-47)
Avail: NTIS HC A17/MF A01 CSCL 04B

It has become evident from operational experience that a good forecast requires, in general, a good analysis. This is as true in the tropics as it is in the extratropics. One can find many examples of bad data being accepted by the analysis scheme and significantly degrading the subsequent forecast. Equally, a lack of data may result in a forecast completely missing the early development of, for example, a midlatitude cyclone or tropical depression. Also, single level data may be misinterpreted by an analysis scheme. These problems are compounded in the tropics by our relative ignorance of the dynamics, the necessarily crude descriptions of many important physical processes, and fundamental in analysis. The impact of the FGGE on tropical analysis/forecasting is reviewed. Author

N86-24132*# Dalhousie Univ., Halifax (Nova Scotia).
SOME COMPARISON OF ECMWF 3b AND GFDL 3b ANALYSES IN THE TROPICS
Paul R. Julian *In* NAS-NRC Proceedings of the First National Workshop on the Global Weather Experiment, Vol. 2, Pt. 1 Oct. 1985 p 211-216 refs Prepared in cooperation with National Center for Atmospheric Research, Boulder, Colo. (For primary document see N86-24121 14-47)
Avail: NTIS HC A17/MF A01 CSCL 04B

Owing to the problems that data assimilation procedures have in analyzing data in the tropics and to the apparent differences in the descriptions of the European Center for Medium Range Weather Forecasts (ECMWF) and Geophysical Fluid Dynamics Laboratory (GFDL) assimilation suites, a brief comparison was done of the resulting analyses in the tropics. Three cases each were selected for Standard Operating Procedures 1 and 2 at the 200 and 850 mb levels, the wind fields for 25 deg N 25 deg S were partitioned into a rotational and divergent component, and various statistics of each were calculated. Author

N86-24133*# European Centre for Medium-Range Weather Forecasts, Reading (England).
THE RESPONSE OF NUMERICAL WEATHER PREDICTION ANALYSIS SYSTEMS TO FGGE 2b DATA
Anthony Hollingsworth, Andrew Lorenc (United Kingdom Meteorological Office, Bracknell, England), Steven Tracton (National Meteorological Center, Washington, D.C.), K Arpe, G. Cats (Koninklijk Nederlands Meteorologisch Inst., De Bilt), S. Uppala, and P. Kallberg (Swedish Meteorological and Hydrological Inst., Norrkoeping) *In* NAS-NRC Proceedings of the First National Workshop on the Global Weather Experiment, Vol. 2, Pt. 1 Oct. 1985 p 217-227 refs (For primary document see N86-24121 14-47)
Avail: NTIS HC A17/MF A01 CSCL 04B

An intercomparison of analyses of the main PGGE Level IIb data set is presented with three advanced analysis systems. The aims of the work are to estimate the extent and magnitude of the differences between the analyses, to identify the reasons for the differences, and finally to estimate the significance of the differences. Extratropical analyses only are considered. Objective evaluations of analysis quality, such as fit to observations, statistics of analysis differences, and mean fields are discussed. In addition, substantial emphasis is placed on subjective evaluation of a series of case studies that were selected to illustrate the importance of different aspects of the analysis procedures, such as quality control, data selection, resolution, dynamical balance, and the role of the assimilating forecast model. In some cases, the forecast models are used as selective amplifiers of analysis differences to assist in deciding which analysis was more nearly correct in the treatment of particular data. Author

N86-24134*# National Center for Atmospheric Research, Boulder, Colo.

ANALYSIS AND FORECAST INTERCOMPARISONS USING THE FGGE SOP-1 DATA BASE

David P. Baumhefner *In* NAS-NRC Proceedings of the First National Workshop on the Global Weather Experiment, Vol. 2, Pt. 1 Oct. 1985 p 226-246 refs (For primary document see N86-24121 14-47)

Avail: NTIS HC A17/MF A01 CSCL 04B

The First GARP Global Experiment (FGGE) data base has provided the research community with the most complete global coverage of meteorological informaiton since measurements were first taken. It is important to understand the characteristics of the FGGE data base in terms of its accuracy and representativeness compared to the true state of the atmosphere. The uncertainty associated with the initial conditions used in a numerical model plays a significant role in subsequent error growth as shown by predictability theory. The ultimate limit of forecast skill is directly related to the initial uncertainty. The accuracy of analyses using FGGE data base coupled with the errors due to modeling imperfections determines the present skill of numerical models. An estimte of initial uncertainty is determined by examining differences in several FGGE analyses. The estimate is then used to determine an ultimate limit of forecast skill from derived predictability error growth rates. Several different calculations of predictability error growth are also compared. Finally, present-day forecast skill using FGGE analyses is contrasted to the estimates of ultimate skill, and the partition of model error versus initial uncertainty is discussed. Author

N86-24135*# Iowa State Univ. of Science and Technology, Ames. Dept. of Earth Sciences.

A COMPARISON STUDY OF SPECTRAL ENERGETICS ANALYSIS USING VARIUS FGGE 3b DATA

Tsing-Chang Chen and Yen-Huei Lee *In* NAS-NRC Proceedings of the First National Workshop on the Global Weather Experiment, Vol. 2, Pt. 1 Oct. 1985 p 247-266 refs (For primary document see N86-24121 14-47)

(Grants NAG5-105; NA82AA-D-00035; NSF ATM-82-06798)

Avail: NTIS HC A17/MF A01 CSCL 04B

The atmospheric spectral energetics studies performed before the First GARP Global Experiment (FGGE) were reviewed, and the deficiencies of these studies were pointed out. The data generated by the FGGE IIIb analyses of the European Center for Medium Range Weather Forecasts, the Geophysical Fluid Dynamics Laboratory, and the Goddard Laboratory for Atmospheric Sciences over the entire globe during the FGGE summer and winter are used to analyze the atmospheric spectral energetics. Comparisons were made between the results using three FGGE IIIb analyses, and between previous and current studies with the spectral energetics of the Southern Hemisphere. Author

N86-24136*# European Centre for Medium-Range Weather Forecasts, Reading (England).

MEDIUM RANGE FORECASTING: THE EXPERIENCE OF ECMWF

Lennart Bengtsson *In* NAS-NRC Proceedings of the First National Workshop on the Global Weather Experiment, Vol. 2, Pt. 1 Oct. 1985 p 269-291 refs Previously announced in IAA as A86-14416 (For primary document see N86-24121 14-47)

Avail: NTIS HC A17/MF A01 CSCL 04B

The results of five years of operational medium-range forecasts at ECMWF is discussed. It is shown that a considerable improvement in predictive skill has taken place, resulting in more accurate forecasts and an extension in time of useful predictive skill. For the Northern Hemisphere extratropics, the improvement in skill during the winter season is about three days for the 500-mb geopotential compared to the very first experiments in the early 1970s. Three are large geographical and temporal variations in the performance of the model, as well as large-scale errors of a systematic nature. Numerical experiments have indicated great sensitivity to the representation of orography and to tropical forcing. Author

N86-24137*# Princeton Univ., N. J. Geophysical Fluid Dynamics Lab.

A MONTHLY FORECAST EXPERIMENT: PRELIMINARY REPORT

Kikuro Miyakoda, J. Sirutis, and Jeffrey J. Ploshay *In* NAS-NRC Proceedings of the First National Workshop on the Global Weather Experiment, Vol. 2, Pt. 1 Oct. 1985 p 292-296 refs (For primary document see N86-24121 14-47)

Avail: NTIS HC A17/MF A01 CSCL 04B

An experiment on monthly forecasts with eight winter cases is being carried out, using a 1980 general circulation model (GCM), which incorporates a set of dubgrid-scale physics characterized by the Mellon-Yamada turbulence closure (hierarchy level 2.5), the Monin-Obukhov parameterization for the layer next to the ground surface, Manabe's cumulus parameterization, and the soil heat conduction. The sample cases adopted are for the month of January in the years from 1977 to 1983, which include the extraordinarily severe winter of 1977 and the most pronounced E1 Nino year of 1983. Each case is predicted by prescribing the climatologically normal sea surface temperature as the lower boundary conditions and by using an ensemble means of three individual integrations. These integrations start with three different initial conditions based on the Level data generated separately at the Geophysical Fluid Dynamics Laboratory, the National Meteorological Center, and the European Centre for Medium Range Weather Forecasts. Author

N86-24138*# Wisconsin Univ., Madison. Space Science and Engineering Center.

THE PLANETARY DISTRIBUTION OF HEAT SOURCES AND SINKS DURING FGGE

Donald R. Johnson and Ming-Ying Wei *In* NAS-NRC Proceedings of the First National Workshop on the Global Weather Experiment, Vol. 2, Pt. 1 Oct. 1985 p 299-316 refs Sponsored in part by the National Science Foundation and NOAA (For primary document see N86-24121 14-47)

Avail: NTIS HC A17/MF A01 CSCL 04B

Heating distributions from analysis of the National Meteorological Center and European Center for Medium Range Weather Forecasts data sets; methods used and problems involved in the inference of diabatic heating; the relationship between differential heating and energy transport; and recommendations on the inference of heat soruces and heat sinks for the planetary show are discussed. Author

N86-24139*# National Center for Atmospheric Research, Boulder, Colo.

PRELIMINARY EVALUATION OF DIABATIC HEATING DISTRIBUTION FROM FGGE LEVEL 3b ANALYSIS DATA

Akira Kasahara and Arthur P. Mizzi *In* NAS-NRC Proceedings of the First National Workshop on the Global Weather Experiments, Vol. 2, Pt. 1 Oct. 1985 p 317-329 refs (For primary document see N86-24121 14-47)

(Grant NA84AA-G-01214)

Avail: NTIS HC A17/MF A01 CSCL 04B

A method is presented for calculating the global distribution of diabatic heating rate. Preliminary results of global heating rate evaluated from the European center for Medium Range Weather Forecasts Level IIIb analysis data is also presented. Author

N86-24140*# Sao Paulo Univ. (Brazil). Dept. of Meteorology.

THE PARTITION OF ENERGY ASSOCIATED WITH TROPICAL HEAT SOURCES

Pedro L. Silva-Dias and Julia N. Paegle (Utah Univ., Salt Lake City) *In* NAS-NRC Proceedings of the First National Workshop on the Global Weather Experiment, Vol. 2, Pt. 1 Oct. 1985 p 331-360 refs Sponsored in part by FAPESP and FINEP, Brazil (For primary document see N86-24121 14-47)

(Grants NAG5-127; NSF ATM-82-19198; NA84AA-G-01214)

Avail: NTIS HC A17/MF A01 CSCL 04B

Data sets derived from observations during the First GARP Global Experiment (FGGE) have permitted the study of the behavior of the tropical atmosphere to an extent not possible before. The

present summary discusses characteristics of the tropical atmosphere which may be a result of tropical heating. It is shown that the meridional component of the divergent wind is of the same order of magnitude an he rotational meridional wind for the planetary tropical scales. Furthermore, the first and second internal modes dominate over most of the tropics, and it is shown that gravity and Kelvin codes are the main contributors to the total tropical divergence. Comparison with averaged station precipitation data and heating estimates obtained from Goddard Laboratory for Atmospheric Science (GLAS)/National Aeronautics and Space Administration (NASA) show good correspondence between areas with maximum internal mode energy and regions with pronounced latent heat release. Author

N86-24141*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
REMOTE SENSING OF ATMOSPHERIC AND SURFACE PARAMETERS FROM HIRS2/MSU ON TIROS-N
Joel Susskind and Eugenia Kalnay *In* NAS-NRC Proceedings of the First National Workshop on the Global Weather Experiment, Vol. 2, Pt. 1 Oct. 1985 p 361-384 refs (For primary document see N86-24121 14-47)
Avail: NTIS HC A17/MF A01 CSCL 04B

At the Goddard Laboratory for Atmospheric Sciences (GLAS) a physically based satellite temperature sounding retrieval system was developed, involving the simultaneous analysis of sounding data, for determining atmospheric and surface conditions that are consistent with the observed radiances. In addition to determining accurate atmospheric temperature profiles even in the presence of clouds, the system provides global estimates of day and night sea or land surface temperatures, snow and ice cover, cloud amounts, cloudtop heights and temperatures, and albedo. The characteristics of the atmospheric and surface parameters derived from the GLAS Physical Retrieval System are reviewed, results for the FGGE year are presented and, whenever possible, compared with other measurements of the same fields. Some of the model-derived diagnostic fields available from the GLAS Analysis/Forecast System are also discussed. These fields may lead to more accurate determination of the source terms of the atmospheric heat and moisture budgets. Author

N86-24142*# National Academy of Sciences - National Research Council, Washington, D. C. Commission on Physical Sciences, Mathematics, and Resources.
PROCEEDINGS OF THE FIRST NATIONAL WORKSHOP ON THE GLOBAL WEATHER EXPERIMENT: CURRENT ACHIEVEMENTS AND FUTURE DIRECTIONS, VOLUME 2, PART 2 Final Report
Oct. 1985 414 p refs Workshop held in Woods Hole, Mass., 9-20 Jul. 1984 Sponsored in cooperation with NASA and NOAA 3 Vol.
(Grant NSF ATM-80-25329)
(NASA-CR-176722; NAS 1.26:176722; PB86-139177) Avail: NTIS HC A18/MF A01 CSCL 04B

An assessment of the status of research using Global Weather Experiment (GWE) data and of the progress in meeting the objectives of the GWE, i.e., better knowledge and understanding of the atmosphere in order to provide more useful weather prediction services. Volume Two consists of a compilation of the papers presented during the workshop. These cover studies that addressed GWE research objectives and utilized GWE information. The titles in Part 2 of this volume include General Circulation Planetary Waves, Interhemispheric, Cross-Equatorial Exchange, Global Aspects of Monsoons, Midlatitude-Tropical Interactions During Monsoons, Stratosphere, Southern Hemisphere, Parameterization, Design of Observations, Oceanography, Future Possibilities, Research Gaps, with an Appendix. For individual titles, see N86-24143 through N86-24164.

N86-24143*# Maryland Univ., College Park. Dept. of Meteorology.
FGGE AND ATMOSPHERIC PREDICTABILITY Final Report
Ferdinand Baer *In* NAS-NRC Proceedings of the First National Workshop on the Global Weather Experiment, Vol. 2, Pt. 2 Oct. 1985 p 387-397 refs (For primary document see N86-24142 14-47)
(Grant NSF ATM-82-12201)
Avail: NTIS HC A18/MF A01 CSCL 04B

FGGE data and its analyses have made significant impact on the prediction community and its understanding of the atmosphere. The detail available from the FGGE data makes understanding of specific issues more precise and opens up new questions not previously recognized. The spectrum of issues to which FGGE data may be addressed includes time scales (stationary and transient), space scales (global versus local), regionality (tropics and oceans), specific weather phenomena (blocking and monsoons), and energetics. In addition to identifying and highlighting atmospheric processes, FGGE data can and were applied to improved atmospheric predictability. This was achieved through model initialization, improved parameterization of model forcing, and more thorough validation of model forecasts. Of particular interest is the increased understanding of the atmosphere and subsequently its predictability, which may be obtained through an assessment of the statistical characteristics of the FGGE data. Author

N86-24144*# Atmospheric and Environmental Research, Inc., Cambridge, Mass.
IMPACT OF FGGE ON DIAGNOSES OF THE GENERAL CIRCULATION Final Report
Richard D. Rosen *In* NAS-NRC Proceedings of the First National Workshop on the Global Weather Experiment, Vol. 2, Pt. 2 Oct. 1985 p 398-421 refs (For primary document see N86-24142 14-47)
(Grant NSF ATM-83-11714)
Avail: NTIS HC A18/MF A01 CSCL 04B

Several studies have pointed out that a number of significant differences exist in circulation fields derived from the various Level IIIb analyses. For example, differences in the strength of the January Hadley cell between the GFDL and ECMWF analyses are as large as 35 percent, and there are some locations over the Northern Hemisphere where the 200 mb zonal wind in January differs by 10 m/s between these two analyses. Calculations of the global energy cycle based on the GFDL and ECMWF analyses are significantly different as well. In addition, the uncertain quality of some of the FGGE IIIb moisture and vertical motion fields raises doubts about whether new insights into the role of these fields in the general circulation will be gained from the FGGE data. Overall, therefore, a sense of disappointment emerges that the FGGE analyses have thus far failed to live up to the expectation that they would yield more definitive general circulation statistics. The shortcomings in the Level IIIb analyses need to be rectified before full confidence can be placed in results pertaining to the general circulation that are based on such modern data assimilation approaches. Author

N86-24145*# Florida State Univ., Tallahassee. Geophysical Fluid Dynamics Inst.
REVIEW OF RESEARCH ON WAVE MEAN FLOW INTERACTIONS USING FGGE DATA Final Report
Richard L. Pfeffer *In* NAS-NRC Proceedings of the First National Workshop on the Global Weather Experiment, Vol. 2, Pt. 2 Oct. 1985 p 422-437 refs (For primary document see N86-24142 14-47)
Avail: NTIS HC A18/MF A01 CSCL 04B

Comparison is made between the conventional Eulerian diagnostics of wave mean flow interactions in the atmosphere and the diagnostics introduced by Andrews and McIntyre (1976). In the latter, the meridional circulation is represented by a residual circulation, and the eddy torque in the zonal momentum equation by the Eliassen-Palm (1960) flux divergence (or equivalently, by the poleward eddy flux of geostrophic potential vorticity). It is found that, while the new diagnostics are useful in studying stratospheric warmings and transports of conservative quantities, the conventional diagnostics are more useful in studying global energetics and wave mean flow interactions in the troposphere and lower stratosphere. Case studies diagnosed with FGGE IIIb

data are presented to illustrate this point. Kung and Tanaka's (1983) comparisons of the atmospheric energy cycle for SOP-1 and SOP-2, estimated with the use of the ECMWF and GFDL FGGE IIIb data bases, are used to assess the uncertainty in calculations of energetics based on the use of FGGE IIIb data. These results demonstrate the high degree of model dependence in the FGGE IIb data sets. Author

N86-24146*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE ROLE OF FGGE DATA IN THE UNDERSTANDING AND PREDICTION OF ATMOSPHERIC PLANETARY WAVES Final report
Wayman E. Baker *In* NAS-NRC Proceedings of the First National Workshop on the Global Weather Experiment, Vol. 2, Pt. 2 Oct. 1985 p 438-450 refs (For primary document see N86-24142 14-47)
Avail: NTIS HC A18/MF A01 CSCL 04B

The augmented observational data base provided by FGGE offers a unique opportunity to improve the understanding and prediction of atmospheric planetary waves. Substantial progress was made, but a number of problems remain. The research on planetary waves conducted thus far with FGGE data is reviewed. Areas of progress are summarized, and some remaining problems are discussed. Author

N86-24147*# Utah Univ., Salt Lake City. Dept. of Meteorology.
INTERHEMISPHERIC INTERACTIONS Final Report
Jan Paegle *In* NAS-NRC Proceedings of the First National Workshop on the Global Weather Experiment, Vol. 2, Pt. 2 Oct. 1985 p 453-468 refs (For primary document see N86-24142 14-47)
(Grants NAG5-127; NSF ATM-82-19198; NSF ATM-80-18158)
Avail: NTIS HC A18/MF A01 CSCL 04B

Diagnoses of global data sets are presented that indicate strong coupling between the regions of enhanced tropical convection of the summer hemisphere and subtropical jet stream maxima of the winter hemisphere. One curious aspect of this coupling is that it tends to occur through zones of easterly winds at upper tropospheric levels. This characterizes the El Nino event of 1983, an upper connection of the Asian monsoon to the Australian jet in FGGE and DST data and shorter term transitions during the First Special Observing Period of FGGE. The reasons for the apparent propagation through easterly wind zones remain to be clarified. Author

N86-24148*# Scripps Institution of Oceanography, La Jolla, Calif. Climate Research Group.
PLANETARY WAVE PREDICTION: BENEFITS OF TROPICAL DATA AND GLOBAL MODELS Final Report
Richard C. J. Somerville *In* NAS-NRC Proceedings of the First National Workshop on the Global Weather Experiment, Vol. 2, Pt. 2 Oct. 1985 p 469-472 refs (For primary document see N86-24142 14-47)
(Grants NAG5-236; NSF ATM-82-05392)
Avail: NTIS HC A18/MF A01 CSCL 04B

Skillful numerical predictions of midlatitude atmospheric planetary waves generally require both tropical data for the initial conditions and a global domain for the forecast model. The lack of either adequate tropical observations or a global domain typically leads to a significant degradation of forecast skill in middle latitudes within the first one to three days of the forecast period. These effects were first discovered by numerical experimentation. They were subsequently explained theoretically, and their importance for practical forecasting was confirmed in a series of prediction experiments using FGGE data. Author

N86-24149*# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
ANALYSIS OF CROSS-HEMISPHERIC INFLUENCES ON THE MONSOON TROUGH AND TROPICAL CYCLONE GENESIS DURING FGGE AND DIURNAL SUBSIDENCE DIFFERENCES Final Report
William M. Gray and Cheng-Shang Lee *In* NAS-NRC Proceedings of the First National Workshop on the Global Weather Experiment, Vol. 2, Pt. 2 Oct. 1985 p 475-494 refs Sponsored in part by the National Science Foundation (For primary document see N86-24142 14-47)
Avail: NTIS HC A18/MF A01 CSCL 04B

For a number of years our project has been studying the cross-equatorial (winter to summer hemisphere) processs that can lead to the day-to-day alterations in the strength of the monsoon trough. These processes are also related to the genesis and intensification of tropical storms. The cross-hemispheric processes that occurred during the FGGE year are currently being studied with the use of the ECMWF analysis. How the winter hemisphere can affect low level cold surge penetration across the equator following cold front passage, and how upper tropospheric anticyclones of the winter hemisphere can produce an intensification of a tropical cyclone of the opposite hemisphere is described. ECMWF analysis of the 00Z versus 12Z diurnal difference in the clear region (10 deg diameter) subsidence occurring in the subtropical Pacific Ocean during FGGE is presented. The general reliability of the FGGE ECMWF analysis with regard to the specification of the large scale structure of tropical cyclones is shown. Author

N86-24150*# Wisconsin Univ., Madison. Dept. of Meteorology.
CROSS-EQUATORIAL AND BOUNDARY LAYER EXCHANGE: A FGGE REVIEW Final Report
John A. Young *In* NAS-NRC Proceedings of the First National Workshop on the Global Weather Experiment, Vol. 2, Pt. 2 Oct. 1985 p 495-516 refs (For primary document see N86-24142 14-47)
(Grant NSF ATM-82-10229)
Avail: NTIS HC A18/MF A01 CSCL 04B

The Global Weather Experiment (FGGE) provided unique data on the interesting phenomenon of cross-equatorial flow. Such motion is a key element of the seasonal cycle of the tropics, especially in monsoonal regions. The IIb obserations, IIIb assimilations, and implied dynamics of the flows are reviewed. Additional emphasis is given to the low level branches concentrated in the planetary boundary layer, including air sea interaction and vertical turbulence processes. The results of a recent MONEX Boundary Layer Workshop are summarized. Author

N86-24151*# Hawaii Univ., Honolulu. Dept. of Meteorology.
GLOBAL ASPECTS OF MONSOONS Final Report
Tako Murakami *In* NAS-NRC Proceedings of the First National Workshop on the Global Weather Experiment, Vol. 2, Pt. 2 Oct. 1985 p 517-540 refs (For primary document see N86-24142 14-47)
Avail: NTIS HC A18/MF A01 CSCL 04B

Recent developments are studied in three areas of monsoon research: (1) global aspects of the monsoon onset, (2) the orographic influence of the Tibetan Plateau on the summer monsoon circulations, and (3) tropical 40 to 50 day oscillations. Reference was made only to those studies that are primarily based on FGGE Level IIIb data. A brief summary is given. Author

N86-24152*# Naval Postgraduate School, Monterey, Calif. Dept. of Meteorology.
MIDLATITUDE TROPICAL INTERACTIONS DURING WINTER Final Report
C.-P. Chang *In* NAS-NRC Proceedings of the First National Workshop on the Global Weather Experiment, Vol. 2, Pt. 2 Oct. 1985 p 543-560 refs (For primary document see N86-24142 14-47)
Avail: NTIS HC A18/MF A01 CSCL 04B

Pre-FGGE and FGGE/MONEX data are used to identify short term midlatitude tropical and longitudinal interactions during the winter monsoon. These interactions occur as cold surges, which develop over the East Asian continent and penetrate deep into the tropics with fast gravity wave speed. The observed interactions that occur after a surge include cyclogenesis and enhanced convection in the equatorial region, feedback from equatorial convection to midlatitude circulation systems, tropical east-west

(Walker) circulations, and cross-equatorial influence. These interactions are also studied theoretically by analytical solutions of linearized shallow water equations. Response to transient forcing (monsoon surges) are mainly in Rossby and Kelvin modes. When the forcing time scale is short, significant gravity modes are also excited. The responses closely resemble observed winter monsoon flow. Responses to stationary forcing show that deep (barotropic) motions propagate energy away into high latitudes and that shallow (baroclinic) motions are trapped around the equator. It is shown that the barotropic teleconnection-type response to tropical sources found in previous numerical studies was due to the specified vertical wind shear and surface friction. Author

N86-24153*# California Univ., Los Angeles. Dept. of Atmospheric Sciences.

STRATOSPHERIC WARMINGS DURING THE WINTER OF 1979 Final Report

Carlos R. Mechoso *In* NAS-NRC Proceedings of the First National Workshop on the Global Weather Experiment, Vol. 2, Pt. 2 Oct. 1985 p 563-580 refs (For primary document see N86-24142 14-47)

Avail: NTIS HC A18/MF A01 CSCL 04B

Some of the arguments crucial to the current understanding of stratospheric warmings are recapitulated briefly. The circulation at 10 mb during the winter of 1979 is described. A review of numerical forecasts of stratospheric warmings reveals that, in general, these events are predictable from several days in advance. In some cases, however, relatively small errors in the predicted tropospheric zonal mean wind produce large differences in upward wave propagation and, consequently, in the stratospheric forecast. Author

N86-24154*# Washington Univ., Seattle. Dept. of Atmospheric Sciences.

DYNAMICAL PHENOMENA IN THE EQUATORIAL MIDDLE ATMOSPHERE DURING NORTHERN WINTER 1978-1979 Final Report

Conway B. Leovy and Matthew H. Hitchman *In* NAS-NRC Proceedings of the First National Workshop on the Global Weather Experiment, Vol. 2, Pt. 2 Oct. 1985 p 581-594 refs (For primary document see N86-24142 14-47)

(Grant NsG-7085)

Avail: NTIS HC A18/MF A01 CSCL 04B

Data from the Limb Infrared Monitor of the Stratosphere (LIMS) on the Nimbus-7 spacecraft were used to calculate the temperature and zonal wind structure of the equatorial stratosphere and lower mesosphere during the period October 25, 1978 to May 28, 1979. Interactions between the descending westerly shear zone of the semiannual oscillation and upward propagating Kelvin waves are described. Inertial instability may be influencing the zonal wind in midwinter. Author

N86-24155*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE ZONAL HARMONIC AND THE YEARLY AND HALF-YEARLY WAVES ON THE SOUTHERN HEMISPHERE IN FGGE COMPARED WITH THE MEAN Final Report

Harry vanLoon (National Center for Atmospheric Research, Boulder, Colo.) and Kingtse C. Mo *In* NAS-NRC Proceedings of the First National Workshop on the Global Weather Experiment, Vol. 2, Pt. 2 Oct. 1985 p 595-645 (For primary document see N86-24142 14-47)

Avail: NTIS HC A18/MF A01 CSCL 04B

The dominant component in the mean annual cycle of sea level pressure in the latitudes north of approx. 40 deg S is the yearly wave, whereas to the south of this latitude a half-yearly wave dominantes. In FGGE, however, the usually small yearly wave was large in the Antarctic, owing to the extraordinarily low pressure there in the winter of 1979. The half-yearly wave's amplitude was appreciably above normal in the center of each ocean in middle latitudes, and below normal at high latitudes. The yearly wave in the zonal geostrophic wind was larger than normal over the Antarctic Ocean. Similar results are obtained at 500 mb. The three month mean stationary waves (zonal harmonic waves) were larger than the mean in FGGE. The intra-annual variation of both amplitude and phase of the monthly mean harmonic waves in FGGE was large, which is not surprising as they contain an appreciable transient component, unlike the long term monthly mean waves. Author

N86-24156*# National Center for Atmospheric Research, Boulder, Colo.

THE SOUTHERN HEMISPHERE CIRCULATION DURING THE FGGE AND ITS REPRESENTATIVENESS Final Report

Kevin E. Trenberth and John R. Christy (Illinois Univ., Urbana) *In* NAS-NRC Proceedings of the First National Workshop on the Global Weather Experiment, Vol. 2, Pt. 2 Oct. 1985 p 646-668 refs (For primary document see N86-24142 14-47)

(Grant NSF ATM-82-11560)

Avail: NTIS HC A18/MF A01 CSCL 04B

An analysis of the global redistribution of mass during the FGGE year indicates that the global circulation was highly anomalous in several respects, especially from April to July 1979. For the 56 to year period 1924-1980, sea-level pressures over the northern hemisphere during the FGGE year were second highest in spring and highest in summer. In April and June, the anomalies were 1-in-100-year events. At the same time, sea-level pressure deficits and an exceptionally deep circumpolar trough were recorded over the Southern Hemisphere. Such compensation between the hemispheres, through the constraint of conservation of mass, provides support for the highly typical nature of the circulation analyzed to exist over the Southern Hemisphere throughout the FGGE year. The Southern Hemisphere circulation was characterized by an exceptionally deep circumpolar trough, an increase in westerlies from 40 deg to 70 deg S, and a decrease in westerlies to the north. In winter, the subtropical jet was weaker and the polar jet stronger than normal, so that a pronounced double jet structure prevailed. In summer, the jet was shifted south by 3 deg latitude. A southward shift in storm tracks accompanied these changes year round in a manner consistent with theory. Author

N86-24157*# Illinois Univ., Urbana. Dept. of Atmospheric Sciences.

RESPONSE OF CUMULUS CLOUDS TO LARGE-SCALE FORCING AND CUMULUS PARAMETERIZATION Final Report

Yoshimitsu Ogura *In* NAS-NRC Proceedings of the First National Workshop on the Global Weather Experiment, Vol. 2, Pt. 2 Oct. 1985 p 671-688 refs Sponsored in part by NOAA (For primary document see N86-24142 14-47)

(Grants NSF ATM-82-11786; NSF ATM-82-10130)

Avail: NTIS HC A18/MF A01 CSCL 04B

Using the cumulus ensemble model (Soong and Ogura, 1980), statistical properties of cumulus clouds that occur in response to the imposed large scale forcing were investigated both in the tropical and midlatitude situtations. A strong drying process was found to occur in the boundary layer in association with deep convection in a midlatitude case. The Arakawa-Schubert (1974) cumulus parameterization scheme was tested semi-prognostically against both the model result and the observation in a tropical rain event that occurred in GATE. The Cloud heating and drying effects predicted by the Arakawa-Schubert scheme were found to agree well both with the observation and the model result. However, it was also found that the Arakawa-Schuber scheme underestimates both condensation and evaporation rates substantially. An inclusion of the downdraft effect, as formulated by Johnson (1976), appears to alleviate this deficiency. This downdraft effect may be important in predicting the behavior of the boundary accurately. Author

N86-24158*# State Univ. of New York, Albany. Dept. of Atmospheric Sciences.

ADVANCES IN PARAMETERIZATION OF CUMULUS CONVECTION IN NUMERICAL MODELS Final Report

John Molinari *In* NAS-NRC Proceedings of the First National Workshop on the Global Weather Experiment, Vol. 2, Pt. 2 Oct. 1985 p 689-705 refs (For primary document see N86-24142

14-47)
Avail: NTIS HC A18/MF A01 CSCL 04B

Observational studies over the last decade have revealed new sources of difficulty in the already complex problem of parameterization of precipitating cumulus convection in large scale numerical weather prediction models. The structure of mesoscale updrafts and downdrafts and the difficulties they present for cumulus parameterization is reviewed. An approach is proposed which follows Kuo (1974) but includes cumulus and mesoscale downdrafts in the vertical distributions of heating and moistening. The development of a realistic life cycle behavior in the numerical prediction of a mesoscale convective complex will be shown.
Author

N86-24159*# European Centre for Medium-Range Weather Forecasts, Reading (England).
A NEW CONVECTIVE ADJUSTMENT SCHEME
Alan K. Betts *In* NAS-NRC Proceedings of the First National Workshop on the Global Weather Experiment, Vol. 2, Pt. 2 Oct. 1985 p 706-724 refs (For primary document see N86-24142 14-47)
(Grant NSF ATM-81-20444)
Avail: NTIS HC A18/MF A01 CSCL 04B

A marked divergence in philosophy is presented. The primary objective of the proposed parameterization scheme is to ensure that the local vertical temperature and moisture structures, which in nature are strongly constrained by convection, be realistic in the large scale model. The concept of a quasi-equilibrium between the cloud field and the large-scale forcing has been well established. This means that convective regions have characteristic temperature and moisture structures that can be documented observationally and used as the basis of a convective adjustment procedure. In the scheme proposed here, the temperature and moisture structures will be adjusted simultaneously toward observed quasi-equilibrium structures. This ensures that on the grid scale a global model always maintains a realistic vertical temperature and moisture structure in the presence of convection. The saturation point formulation of moist thermodynamics will be used to introduce the observational and theoretical basis of the proposed convective adjustment. The scheme is then applied to a series of data sets from GATE, BOMEX, ATEX and an Arctic air-mass transformation to show the sensitivity of the scheme to different parameters and develop a parameter set suitable for both shallow and deep convection in a global model.
Author

N86-24160*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SIMULATION STUDIES RELATED TO THE DESIGN OF POST-FGGE OBSERVING SYSTEMS Final Report
Milton Halem, R. Atlas, and Joel Susskind *In* NAS-NRC Proceedings of the First National Workshop on the Global Weather Experiment, Vol. 2, Pt. 2 Oct. 1985 p 727-760 refs (For primary document see N86-24142 14-47)
Avail: NTIS HC A18/MF A01 CSCL 04B

The results of three detailed simulation studies are presented. The first study consists of a comparative assessment of the performance of an advanced moisture/temperature sounder (AMTS) being proposed by NASA as a follow-on replacement to the current HIRS-2 operational sounder aboard the NOAA weather satellites. The second study was concerned with assessing the relative accuracies of inferred atmospheric states for idealized lidar wind profiling systems, temperature profiling systems, temperature profiling systems, surface pressure systems, and composite systems. The third study incorporated the above systems into a highly realistic data analysis/forecast cycle from which a series of forecast impact studies were conducted. These studies, taken together, give us a picture of the potential that emerging technoloies can offer in the determination of the basic atmospheric variables required for long-range numerical weather and climate prediction.
Author

N86-24161*# Scripps Institution of Oceanography, La Jolla, Calif.
SEA SURFACE TEMPERATURE FROM SATELLITES: THE IMPACT OF FGGE Final Report
Robert L. Bernstein *In* NAS-NRC Proceedings of the First National Workshop on the Global Weather Experiment, Vol. 2, Pt. 2 Oct. 1985 p 761-764 refs (For primary document see N86-24142 14-47)
Avail: NTIS HC A18/MF A01 CSCL 04B

Spacecraft instruments first launched at the beginning of the FGGE year are now producing sea surface temperature data accurate to about 1 C. At larger scales, the errors are dominated by systematic effects, some of which are instrumental, but most are geophysical, i.e., correlated with volcanic aerosols, atmospheric water vapor, clouds, and surface wind. Progress is being made to identify and eliminate such errors and thereby provide sea surface temperature data on a global basis consistently accurate to 0.5 C, which will be needed for studies of climate variability.
Author

N86-24162*# National Oceanic and Atmospheric Administration, Seattle, Wash.
MODELING SEA-SURFACE TEMPERATURE AND ITS VARIABILITY Final Report
Edward S. Sarachik *In* NAS-NRC Proceedings of the First National Workshop on the Global Weather Experiment, Vol. 2, Pt. 2 Oct. 1985 p 765-778 refs (For primary document see N86-24142 14-47)
(Grant NGL-22-007-228)
Avail: NTIS HC A18/MF A01 CSCL 04B

A brief review is presented of the temporal scales of sea surface temperature variability. Progress in modeling sea surface temperature, and remaining obstacles to the understanding of the variability is discussed.
Author

N86-24163*# National Oceanic and Atmospheric Administration, Miami, Fla. Oceanographic and Meteorological Lab.
HEAT BALANCES OF THE SURFACE MIXED LAYER IN THE EQUATORIAL ATLANTIC AND INDIAN OCEAN DURING FGGE
Robert L. Molinari *In* NAS-NRC Proceedings of the First National Workshop on the Global Weather Experiment, Vol. 2, Pt. 2 Oct. 1985 p 779-790 refs (For primary document see N86-24142 14-47)
Avail: NTIS HC A18/MF A01 CSCL 04B

Surface meteorological and surface and subsurface oceanographic data collected during FGGE in the equatorial Atlantic and Indian Oceans are used to estimate the terms in a heat balance relation for the mixed layer. The first balance tested is between changes in mixed layer temperature (MLT) and surface energy fluxes. Away from regions of low variance in MLT time series and equatorial and coastal upwelling, surface fluxes can account for 75 percent of the variance in the observed time series. Differences between observed and estimated MLTs indicate that on the average, maximum errors in surface flux are of the order of 20 to 30 W/sq m. In the Atlantic, the addition of zonal advection does not significantly improve the estimates. However in regions of equatorial upwelling, the eastern Atlantic vertical mixing and meridional advection can play an important role in the evolution of MLTs.
Author

N86-24164*# New York Univ., New York. Inst. of Mathematical Sciences.
FUTURE POSSIBILITIES IN OJBECTIVE ANALYSIS AND DATA ASSIMILATION FOR ATMOSPHERIC DYNAMICS Final Report
M. Ghil *In* NAS-NRC Proceedings of the First National Workshop on the Global Weather Experiment, Vol. 2, Pt. 2 Oct. 1985 p 794-802 refs (For primary document see N86-24142 14-47)
(Contract NAS5-27612; Grant NsG-5130)
Avail: NTIS HC A18/MF A01 CSCL 04B

The role that dynamics plays in estimating the state of the atmosphere from incomplete and noisy data is reviewed. Objective analysis represents an attempt at relying mostly on the data and minimizing the role of dynamics in the estimation. Data assimilation tries to balance properly the roles of dynamical and observational information. Sequential estimation is presented as the proper

framework for understanding this balance, and the Kalman filter as the ideal, optimal procedure for data assimilation. The optimal filter computes forecast error covariances of a given atmospheric model exactly, and hence data assimilation should be closely connected with predictability studies. This connection is described, and consequences drawn for currently active areas of the atmospheric and related sciences, namely, mesoscale meteorology, long range forecasting, and upper ocean dynamics. Possibilities offered by judicious data assimilation in understanding barotropic adjustment, a phenomenon that appears to play a crucial role in atmospheric behavior on the scale of weeks to months, and hence in long range forecasting are addressed. Author

N86-24165# National Weather Service, Salt Lake City, Utah.
LARGE SCALE PATTERNS ASSOCIATED WITH MAJOR FREEZE EPISODES IN THE AGRICULTURAL SOUTHWEST
R. S. Hamilton and G. R. Lussky Dec. 1985 43 p
(PB86-144474; NOAA-TM-NWS-WR-191) Avail: NTIS HC A03/MF A01 CSCL 04B

The Technical Memorandum is geared toward those who are responsible for forecasting minimum temperatures for growers of frost-sensitive agriculture. It is slanted toward forecasting in California, though the prinicples applied in this document may also apply to other Western region locales as well. The primary goal of this paper is to get forecasters thinking about frost and to prepare them to forecast frost and freeze conditions before the winter months arrive. This paper will help prepare the forecasters to recognize, in advance, the situations which often lead to freezing conditions in the agricultural regions of the western United States. GRA

N86-24521*# Texas A&M Univ., College Station. Dept. of Meteorology.
OBSERVATIONAL AND NUMERICAL STUDIES OF THE LOW-LEVEL JET STREAM IN THE ATMOSPHERE
Dusan Djuric *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 21 p refs (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 04B

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N86-24166# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
DEVELOPMENT OF A SATELLITE-TRACKED OCEANOGRAPHIC DRIFTING BUOY FOR THE BRAZILIAN ANTARCTIC PROGRAM, PART 1
Merritt R. Stevenson and Eduardo M. B. Alonso Feb. 1986 24 p refs Submitted for publication
(INPE-3793-PRE/888) Avail: NTIS HC A02/MF A01

The project Measurement of the Antarctic Current (MEDICA) which was to develop, build and launch drifting oceanographic buoys, located by System ARGOS, in Antarctica is presented. The basis of the drifting buoy was to used a data collection platform (DCP). A biconic geometry was used for the buoy hull to provide good vertical stability and resistance to entrapment by ice. Fiberglass was used for its high strength to weight ratio, and the facility to use molds for production of the hulls. Sandwich construction was incorporated and provided for outer and inner hulls of fiberglass with polyurethane foam between the walls. Within the hull, the DCP unit and its interface box are mounted within a metal conical rack. The transmitting antenna is mounted on a metal base-plane disc and, in turn, is secured atop the rack. A power supply, consisting of several hundred alkaline dry cells, suitably interconnected and sealed within a plastic housing, resides below the rack for maximum buoy stability. An additional thermistor is mounted in a housing on the conical cover of the buoy and provides air temperature readings. The physical specifications and measuring capabilities of the sensors. E.A.K.

N86-24167# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
VARIATIONS IN TEMPERATURE, SALINITY AND DENSITY IN BRANSFIELD STRAIT, 9-14 MARCH, 1985, PART 2
Merritt R. Stevenson, Hector M. InostrozaV, and Jose L. Stech Feb. 1986 23 p refs Submitted for publication
(INPE-3794-PRE/889) Avail: NTIS HC A02/MF A01

During a test experiment of a drifting buoy, 7 hydrographic stations were made in Bransfield Strait during 9 to 14 March. Each station consisted of 2 hydrographic casts with Nansen bottles and reversing thermometers, made to a maximum depth of 300 m, to obtain temperature measurements and water samples for salinity determinations. Horizontal maps of temperature (T), salinity (S) and sigma-t (density) were constructed for 0 m and 10 m depth. Warmer surface water was observed along the west side of the Strait, in comparison with temperatures of 0.51 to 0.56 C along the east side. Surface salinity had a similar pattern with less saline water on the west side and salinities of 34.22 to 34.24 on the east side. The surface density field agreed with the combined effects of T and S, with less dense water on the west side and denser water on the east side. Warmest, less saline and least dense water was found just to the SE of Deception Island (Station 1). Maps of T, S and sigma-t for 10 m depth were generally similar to those at 0 m, but with cooler, more saline and dense water at 10 m depth. The relative geostrophic velocity field, was also determined, for 0 m and 10 m. Surface geostrophic flow was toward 020 deg at 4 cm/s near Deception Island. A T-S Diagram analysis of station data showed these data to be a combination of Brc and Brw water types. Author

N86-24168# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
COMPARISON OF CIRCULATION ESTIMATES AND WINDS BASED ON SHIPBOARD AND SATELLITE-TRACKED BUOY DATA IN BRANSFIELD STRAIT, 9-14 MARCH, 1985, PART 3
Merritt R. Stevenson, Hector M. InostrozaV, Jose Luiz Stech, and Eduardo M. B. Alonso Feb. 1986 21 p refs Submitted for publication
(INPE-3795-PRE/890) Avail: NTIS HC A02/MF A01

The INPE freely drifting prototype oceanographic buoy (System ARGOS) was launched successfully on 9 March at 19:31 GMT, for a several day test experiment. During the 9 to 14 March, 1985, interval, a set of 7 hydrographic stations was made in the Bransfield Strait to obtain information about temperature, salinity and density. Results of the several day drifter trajectory are presented together with a comparison with geostrophic circulation, surface winds and air and sea temperatures. Mean drifter velocity was 27.0 cm/s toward 042 deg and confirmed a predicted NE movement for the surface water layer. The surface geostrophic current was toward 020 deg at 4 cm/s, at 10 m depth the current was toward 045 deg at 5 cm/s. Best agreement was found between the rifter trajectory and the geostrophic current at 10 m depth. At the time of buoy launch and for about one day thereafter, winds were weak and toward 090 deg; after another day, however, the surface winds changed and blew generally toward 250 deg at speeds that gradually increased up to 16 kts, in opposition to the surface water motion. Air and water temperatures measured from the buoy are also discussed and compared with measurements made at the hydrographic stations. Author

N86-24169# Naval Ocean Research and Development Activity, Bay St. Louis, Miss.
PRELIMINARY ENVIRONMENTAL ASSESSMENT OF THE PROJECT GEMINI SITE CORPUS CHRISTI, TEXAS
J. E. Matthews, P. J. Bucca, and W. H. Geddes Sep. 1985 31 p
(AD-A161895; NORDA-120) Avail: NTIS HC A03/MF A01 CSCL 20/1

This report is a preliminary assessment of the environment along parts of the continental shelf off Corpus Christi, Texas, and predicts acoustic propagation for a specific site within the area. A

geoacoustic model is developed, based upon archived high-resolution seismic and sediment core data. Theoretical bottom loss, transmission loss, and mode attenuations are calculated using these environmental models as input. Finally, an environmental acoustic evaluation is presented for guidance in the post-experiment analysis, and a comparison is made between the present evaluation and a previous acoustic experiment conducted at this location. GRA

N86-24170# SACLANT ASW Research Center, La Spezia (Italy).
AN ATLAS OF ORIGINAL AND MERCATOR-TRANSFORMED SATELLITE-DATA IMAGES OF THE ALBORAN SEA, AUGUST-OCTOBER 1983
Elvio Nacini 1 Aug. 1985 132 p
(AD-A161898; SACLANTCEN-SR-89) Avail: NTIS HC A07/MF A01 CSCL 14/5

A collection of satellite (NOAA7) images of the Alboran Sea in High Resolution Picture Transmission (HRPT) and Automatic Picture Transmission (APT) format in the visible, near-infrared, and thermal infrared fields is presented. Some of them have been transformed to Mercator projection in order to show how the use of such images can aid in the preparation and conduct of oceanographic and other operations. The contents include: image collection and processing, transformation to Mercator projection, application to oceanographic studies, water masses, temperature profiling, comparison with synoptic weather charts, and tidal data. GRA

N86-24171# Woods Hole Oceanographic Institution, Mass.
ESTIMATION OF PLANETARY WAVE PARAMETERS FROM THE DATA OF THE 1981 OCEAN ACOUSTIC TOMOGRAPHY EXPERIMENT Ph.D. Thesis
Ching-Sang Chiu Oct. 1985 265 p
(Contract N00014-82-C-0019)
(AD-A161983; WHOI-85-33) Avail: NTIS HC A12/MF A01 CSCL 20/1

Using the maximum-likelihood estimation method and minimization techniques, quasi-geostrophic wave solutions were fitted to the observations of the 1981 Ocean Acoustic Tomography Experiment. The experiment occupied a 300 km square area centered at 26 N, 70 W, and had a duration of approx. 80 days. The data consisted of acoustic travel-time records, and ship surveys, respectively. While the latter two were conventional spot measurements, the former corresponds to integral measurements of the temperature (or sound-speed) field. The optimal fit to the data corresponded to 3 waves in the first baroclinic mode, evolving under the presence of a westward mean flow with vertical shear. The flow was estimated to be weak (approx. 2 cm/s), but it changed the wave periods significantly by producing large Doppler shifts. The waves were dynamically stable to the mean flow, had weak nonlinear interactions with each other and did not form a resonant traid; thus they constituted a fully linear solution. Evidence for the existence of the waves was strongly supported by the high correlation (approx. 0.9) between the data and the fit, the large amount of signal energy resolved (approx. 80 percent), the excellent quality of the wave-parameter estimate (only about 10 percent in error), and the general agreement between the observations and quasi-geostrophic linear dynamics. Author (GRA)

N86-24172# Naval Ocean Research and Development Activity, Bay St. Louis, Miss.
OCEAN WAVE SLOPE STATISTICS FROM AUTOMATED ANALYSIS OF SUN GLITTER PHOTOGRAPHS Final Report
Matthew Lybanon Jun. 1985 65 p
(AD-A161995; NORDA-103) Avail: NTIS HC A04/MF A01 CSCL 08/3

The image of the Sun reflected from the rough surface of the sea forms a diffuse pattern, whose details depend on the nature of the surface waves and swell. Consequently, statistics of the slope distribution of the sea surface are related to the statistics of the Sun's glitter on the sea surface. Aerial photographs are a convenient medium for recording the glitter pattern. The mathematical relationship to derive the sea surface slope statistics can be determined from an analysis of the imaging geometry. However, analysis of the photographs can be a labor-intensive procedure. The problem was first studied over thirty years ago. Now, there are modern digital image processing systems and techniques that greatly increase the practicality of the analysis. This report derives the relevant equations and describes an implementation on the Interactive Digital Satellite Image Processing System (IDSIPS). The IDSIPS system is operated by the Remote Sensing Branch of the Naval Ocean Research and Development Activity (NORDA). The report includes full formal documentation of the computer software. Author (GRA)

N86-24173# Naval Ocean Research and Development Activity, Bay St. Louis, Miss.
CONTRIBUTIONS TO THE OCEANOGRAPHY OF THE WESTERN ALBORAN SEA Final Report
R. Arnone, R. Barcala, G. Dawson, F. Fiedler, and G. Heburn Apr. 1985 120 p Presented at the 29th Congress and Plenary Session of the International Commission for the Scientific Exploration of the Mediterranean Sea, Lucerne, Switzerland, 11-19 Oct. 1984
(AD-A162019; NORDA-TN-315) Avail: NTIS HC A06/MF A01 CSCL 08/3

This compilation includes the following articles: Donde Va? An Oceanographic Experiment in the Alboran Sea. The Donde Va Group; The Hydrographic Structure of the Alboran Sea Gyre, June and October 1982; NIMBUS-7/CZCS Derived Maps of Near-Surface Chlorophyll; The Flow of Atlantic Water into the Alboran Sea During Donde Va; A Time Series Station at the Eastern Entrance of the Strait of Gibraltar; A Preliminary Study of a Standing Interval Wave in the Western Approaches to the Strait of Gibraltar; Effects of Wind Versus Hydraulic Forcing on the Dynamics of the Western Mediterranean Sea; and Computational Methods for Two Problems in Air-Sea Interaction. GRA

N86-24174# Royal Australian Navy Hydrographic Service, Canberra.
REPORT OF THE HYDROGRAPHIC SERVICE ROYAL AUSTRALIAN NAVY FOR THE YEAR ENDED 30TH JUNE 1985, ISSUE NUMBER 21 Annual Report, 1 Jul. 1984 - 30 Jun. 1985
1985 48 p
(AD-A162023) Avail: NTIS HC A03/MF A01 CSCL 08/10

This compilation includes the following articles and features: Hydrographic Survey Operations and Plans; Oceanographic Operations; Oceanography and Meteorology; Personnel; Training; Chart Production and Maintenance; Chart Distribution; Notices to Mariners; Sailing Directions, Nomenclature, and Maritime Boundaries; Tides; Equipment; and Records and Library; System Support. Author (GRA)

N86-24175# Naval Ocean Research and Development Activity, Bay St. Louis, Miss.
SEAFLOOR GEOSCIENCES DIVISION. MISSIONS, TECHNICAL SPECIALTIES, ACCOMPLISHMENTS AND ACTIVITIES, CALENDAR YEAR 1984 Final Report
F. L. Nastav and Richard H. Bennett Jul. 1985 48 p
(AD-A162040; NORDA-TN-318) Avail: NTIS HC A03/MF A01 CSCL 08/10

The Seafloor Geosciences Div. provides the Navy with expanded and advanced capabilities to conduct comprehensive geological, geophysical, and geotechnical investigations of the sea floor and sub-sea floor. Basic and applied research studies contribute to the fundamental knowledge of the oceanic crust and overlying sediments and the effective utilization of the sea floor. Interdisciplinary seafloor science and engineering investigations are ongoing in support of Navy problems, systems design, construction, and operations. Studies provide quantitative and qualitative description and understanding of the seafloor geological materials and environmental parameters directed toward advancing the state-of-the-art. This report summarizes the division's research accomplishments and professional activities for calendar year 1984. GRA

N86-24176# Naval Postgraduate School, Monterey, Calif.
HYDROGRAPHIC DATA FROM THE OPTOMA PROGRAM, OPTOMA17: OPTOMA17 P, 21 JULY 1985, OPTOMA17 LEG DI, 10-22 AUGUST 1985, OPTOMA17 LEG DII, 23 AUGUST - 5 SEPTEMBER 1985 Report, Oct. 1982 - Sep. 1985
Paul A. Wittmann, Edward A. Kelley, Jr., and Christopher N. K. Mooers Oct. 1985 133 p
(AD-A162067; NPS68-85-026) Avail: NTIS HC A07/MF A01 CSCL 08/3

The Ocean Prediction Through Observations, Modeling and Analysis (OPTOMA) Program seeks to understand the mesoscale (fronts, eddies, and jets) variability and dynamics of the California Current System and to determine the scientific limits to practical mesoscale ocean forecasting. To help carry out the aims of this project, a series of cruises has been planned in two subdomains, NOCAL and CENCAL. The two cruises and one AXBT flight comprising OPTOMA17 were undertaken in the USNS DE STEIGUER and a Reserve Patrol Wing P3B aircraft. Hydrographic data were acquired off the coast of California in an area which covered and extended the NOCAL region. On each of these cruises, hydrographic stations were occupied at approximately 19 km along the track. For the AXBT flight, the along-track station spacing varied between about 28 km and about 46 km. Data acquired during Legs DI and DII include XBT and CTD profiles; whereas data acquired during Leg P are AXBT profiles. Bucket surface temperatures were taken at all CTD stations. A Rosette sampler was used to acquire deep salinity samples. These salinity samples were used for calibration purposes as well as contributions to the data base. GRA

N86-24177# Naval Postgraduate School, Monterey, Calif.
VARIATION OF THE DRAG COEFFICIENT WITH WIND AND WAVE STATE M.S. Thesis
Beverly J. Byars Sep. 1985 111 p
(AD-A162252) Avail: NTIS HC A06/MF A01 CSCL 04/2

The dissipation method is used to obtain estimates for the friction velocity U sub *, as well as values for the neutral drag coefficient, CDN, for data collected from a coastal tower off San Diego, California. C sub DN is found to be independent of the ten-meter height windspeed, U sub 10, for velocities between 4-9 m/sec. Its value is estimated to be (0.94 + or - 0.4)1000 which compares well with values by Smith (1980) and Large and Pond (1981). Definite trends in C sub DN with fetch and sea state are also observed. Drag coefficient estimates are found to be higher for short fetch than for long fetch conditions. C sub DN is also seen to increase sharply just before frontal passages and during sea breeze conditions when the waves are actively growing. With the windspeed and wave field reaching equilibrium, C sub DN is found to decrease with time to a smaller and more constant value. Author (GRA)

N86-24178# Scripps Institution of Oceanography, La Jolla, Calif.
ANALYSIS OF MSS (MARINE SEISMIC SYSTEM) AND OBS (OCEAN BOTTOM SEISMOGRAPH) DATA COLLECTED DURING THE NGENDEI SEISMIC EXPERIMENT Semiannual Report, 1 Jan. 1984 - 30 Aug. 1985
John A. Orcutt Aug. 1985 66 p
(Grant AF-AFOSR-0043-84; DARPA Order 4983)
(AD-A162354; AFOSR-85-1102TR) Avail: NTIS HC A04/MF A01 CSCL 08/11

The results of the first year's data analysis employing data collected during the NGENDEI seismic experiment in the southwest Pacific are presented. This experiment tested the DARPA Marine Seismic System and verified the improved signal-to-noise ratio achieved by burying the instrument within the oceanic crust. The experiment, which took place on the Deep Sea Drilling Project Leg 91, was designed to test the Marine Seismic System (MSS) in a realistic environment near an active trench environment. An earlier test of the system in the northwest Pacific had been unsuccessful because of difficulties in drilling an acceptable borehole in the seafloor. The MSS was recorded aboard the D/V Glomar Challenger for several days of earthquake, refraction and environmental noise experiments. The subsequent deployment of an autonomous recording package on the seafloor was successful. GRA

N86-24179# Coastal Engineering Research Center, Vicksburg, Miss.
EVALUATION OF SEISMOMETER WAVE GAGE AND COMPARATIVE ANALYSIS OF WAVE DATA AT YAQUINA AND COQUILLE BAYS, OREGON Final Report, Jun. 1984 - Feb. 1985
Edward F. Thompson, Gary L. Howell, and Jane M. Smith Sep. 1985 62 p
(AD-A162940; CERC-85-12) Avail: NTIS HC A04/MF A01 CSCL 08/11

A preliminary evaluation of the seismometer wave gage system developed by Oregon State University (OSU) is provided.. The background and theoretical basis for the OSU system is reviewed. An empirical evaluation is obtained by comparing Yaquina Bay seismometer analyses with data from a pressure gage in the same area during 22 February to 5 March 1984. The pressure gage was funded by the US Army Engineer District, Portland. The OSU system appears to be well suited as a sea state indicator for real-time operational purposes. The system has inherent limitations, particularly for estimating wave period. Comparisons with the pressure gage indicate significant wave heights from the seismometer system are relatively reliable. The correlation coefficient is 0.98, and the mean significant heights differ by 8 percent. Suggestions for improving the seismometer system are provided. The OSU method for analyzing seismometer strip chart records is compared wtih Coastal Engineering Research Center (CERC) method developed for this study. The CERC method appears to have small advantages. Guidelines for interpreting past OSU analyses are provided. A 2-month comparison between the seismometer and a pressure gage near Coquille Bay is also included. This site has the nearest available coastal gage record with longer-term operation. The gage is funded by the Corps of Engineers' Field Data Collection Program. Despite the distance between sites the comparison is favorable, particularly during high-energy winter wave conditions. Author (GRA)

N86-24180# Lamont-Doherty Geological Observatory, Palisades, N. Y.
MARGINAL ICE ZONE EXPERIMENT - 1984, PHYSICAL OCEANOGRAPHY REPORT: USNS LYNCH AND HELICOPTER-BASED STD DATA
T. O. Manley Dec. 1985 291 p
(Contract N00014-84-C-0132)
(AD-A163096; LDGO-85-7) Avail: NTIS HC A13/MF A01 CSCL 08/10

During the summer of 1984, the Arctic Oceanography Department of Lamont-Doherty Geological Observatory acquired a total of 222 helicopter-based C/STD stations within the ice-covered region of the Fram Strait to a nominal depth of 500 m. This program was accomplished as part of an international experiment known as MIZEX East 1984. The two ships used in helicopter operations the F/S Polarstern and the M/V Polarqueen. The USNS Lynch was also used to obtain 26 CTD stations from two separate legs into the Fram Strait. The first leg primarily consisted of an open water transect of the strait at a latitude of 79 N. Stations were typically taken to within 10 m of the bottom and extended from the ice edge onto the shelf of Svalbard. The second leg was more acoustically oriented and confined to the southern region of the Yermak Plateau. During this leg, 11 stations to a nominal depth of 450 m were taken. Standard level listings of temperature, potential temperature, salinity, sigma-t, specific volume anomaly, dynamic height, and sound velocity are given for each cast along with profiles of temperature, salinity and sigma-t. Author (GRA)

N86-24181# Lamont-Doherty Geological Observatory, Palisades, N. Y.
PHYSICAL OCEANOGRAPHY REPORT: CAMP-BASED AND HELICOPTER-BASED STD DATA FROM THE DRIFTING ICE STATION FRAM 3

T. O. Manley and Dennis B. Camp Dec. 1985 339 p
(Contract N00014-84-C-0132)
(AD-A163097; LDGO-85-8) Avail: NTIS HC A15/MF A01 CSCL 08/10

During the spring of 1981, a manned camp was established on a drifting ice floe north of Spitzbergen. During the 61 days of occupation, the Arctic Oceanography Department of Lamont-Doherty Geological Observatory obtained a total of 194 STD stations from the combined efforts of personnel in charge of camp-based and helicopter-based operations. This report describes the methods used in the acquisition and processing of the data and provides output for each case. The output consists of standard level listings of temperature, potential temperature, salinity, sigma-t, specific volume anomaly, dynamic height, and sound velocity, along with corresponding profiles of temperature, salinity and sigma-t.
Author (GRA)

N86-24182# National Science Foundation, Washington, D.C. Div. of Polar Programs.
PROBLEMS OF THE ARCTIC AND THE ANTARCTIC, COLLECTION OF ARTICLES, VOL. 57, 1981
A. F. Treshnikov, ed. 1985 151 p Transl. into ENGLISH of Sbornik Statei (USSR), v. 57, 1981 p 1-142
(PB86-106994; TT-82-00-104) Avail: NTIS HC A08/MF A01 CSCL 08C

Problems of polar oceanography; hydrochemical studies in the Arctic Ocean; general distribution variability of ice in the World Ocean as a climate-forming factor; air-sea interaction in the Arctic basin and the North Atlantic; physics of ice and the ocean; long-range meteorological forecasts are reported. GRA

N86-24183# National Oceanic and Atmospheric Administration, Seattle, Wash. Pacific Marine Environment Lab.
UNPOLARIZED IRRADIANCE REFLECTANCES AND GLITTER PATTERNS OF RANDOM CAPILLARY WAVES ON LAKES AND SEAS, BY MONTE CARLO SIMULATION
R. W. Preisendorfer and C. D. Mobley Sep. 1985 148 p refs
(PB86-123577; NOAA-TM-ERL-PMEL-63) Avail: NTIS HC A07/MF A01 CSCL 08J

A Monte Carlo procedure is developed for estimating the unpolarized irradiance reflectances and glitter patterns of a wind-roughened sea surface as a function of environmental lighting conditions and wind speed, given the statistical properties of the surface. The procedure includes the effects of multiple scattering of light rays and their shielding by wave facets. As the optical properties of the sea surface are determined primarily by capillary waves, even in the presence of gravity waves, our attention is directed mainly at the proper treatment of the capillary wave case. However, for completeness and possible future use, a model also is developed which allows an exact calculation of the optical properties of a wind-roughened surface which has the form of a spatially stationary process over the full capillary-gravity range of water waves. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N86-24184# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
US DEPARTMENT OF AGRICULTURE/CORPS OF ENGINEERS COOPERATIVE AQUATIC PLANT CONTROL RESEARCH. ANNUAL REPORT FOR FY 1983; CHEMICAL CONTROL TECHNOLOGY Final Report
Thai K. Van, Kerry K. Steward, Ann O. Jones, Richard D. Conant, Jr., and Howard E. Westerdahl Sep. 1985 70 p
(AD-A161867; WES/MP/A-85-3) Avail: NTIS HC A04/MF A01 CSCL 06/6

Of the several controlled release herbicide formulations evaluated in FY83, two monolithic polycaprolactone fibers containing fluridone have been found to have significant potential. These fibers, designed to maintain herbicide-plant contact over a period of four to 6 weeks, were proven effective in controlling hydrilla (Hydrilla verticillata Royle) at 2.2 kg a.i./ha (active ingredient per hectare) in flowing water in large outdoor aquaria. Under the same conditions, the commercial formulation Sonar 4AS provided no hydrilla control. Two silicate capsules of dichlobenil showed promising results in the laboratory and were selected for evaluations in large outdoor aquaria in which long-term control of hydrilla regrowth was assessed. Research concerning application of glyphosate indicated that decreasing carrier volume increased phytotoxicity of glyphosate to waterhyacinth, mainly by enhancing herbicide retention and penetration. A treatment of 1.7 kg a.e./ha (acid equivalent per hectare) glyphosate in 438 L/ha water carrier resulted in faster and longer lasting control than did 2.8 kg a.e./ha in 935 L/ha. Long-term effects from glyphosate on torpedograss in standing water were significantly reduced compared to activity achieved on ditchbanks. Studies with 14C-glyphosate indicated that herbicide translocation was impeded in standing water. Sulfumeturon at 0.02 kg a.i./ha completely eradicated waterhyacinth in a 0.07-ha pond in Fort Lauderdale. Residue analyses indicated that levels of 1.3 to 1.6 microgram/L sulfumeturon were present in water 24 hr after application; then decreased rapidly.
GRA

N86-24185# National Academy of Sciences - National Research Council, Washington, D. C. Commission on Life Sciences.
STUDY OF BIOTECHNOLOGY APPLIED TO RESEARCH AND DEVELOPMENT
8 Jan. 1985 43 p
(Contract N00014-83-G-0024)
(AD-A161877) Avail: NTIS HC A03/MF A01 CSCL 15/2

This report contains summaries of a conference on biosensors, along with the deliberations of the Commitee on Biotechology Applied to Naval Needs. For the purposes of this report, biosensors are defined as devices that utilize some principles or elements of biology, broadly defined, to generate a signal in response to a specific material substance or condition. The committee considered that the appropriate areas of biology to consider were the study of receptors, enzymology, the use of DNA as a detector, immunologly, and the development of synthetic analogs to the relevant natural biological reactions. In contrast to a recent report prepared by the NRC's Board on Army Science and Technology, entitled Assessment of Chemical and Biological Sensor Technologies, which was written in response to a very narrowly and sharply defined charge, the present report focuses on basic biology relevant to biosensors. GRA

N86-24186# Army Medical Research Inst. of Infectious Diseases, Fort Detrick, Md.
CLONING AND ANALYSIS OF GENES FOR ANTHRAX TOXIN COMPONENTS
Stephen H. Leppla, Donald L. Robertson, Susan L. Welkos, Leonard A. Smith, and Michael H. Vodkin 29 Aug. 1985 6 p
(S18-06)
(AD-A161901) Avail: NTIS HC A02/MF A01 CSCL 06/15

Genetic analysis and DNA cloning techniques have been used to study the plasmids and genes which determine synthesis of the three protein components of anthrax toxin. After plasmid curing and transfer experiments showed that all three genes were probably located on the large B. anthracis plasmid pX01, DNA libraries of pX01 DNA were constructed. Five colonies containing at least part of the lethal factor gene and six colonies containing protective antigen DNA were identified, and their plasmids were mapped by restriction enzyme digestion. The absence of an equal number of edema factor (EF) recombinants was attributed to the possibility that the EF adenylate cyclase is toxic to the host E. coli.
Author (GRA)

N86-24187# Army Medical Research Inst. of Infectious Diseases, Fort Detrick, Md.
IDENTIFICATION OF VACCINE RESISTANT ISOLATES OF BACILLUS ANTHRACIS
Stephen F. Little and Gregory B. Knudson 13 Nov. 1985 23 p

(AD-A162002) Avail: NTIS HC A02/MF A01 CSCL 06/13
Several strains of Bacillus anthracis have been reported previously to cause fatal infection in immunized guinea pigs. In this study, guinea pigs were immunized with either a protective antigen vaccine or a live Sterne strain spore vaccine, then challenged with virulent B. anthracis strains isolated from various host species from the United States and foreign sources. The authors concluded that antibodies to toxin components may not be sufficient to provide protection against all strains of B. anthracis, and that other antigens may play a role in active immunity. As a practical matter, it follows that the efficacy of anthrax vaccines must be tested by using vaccine-resistant isolates if protection against all possible challenge strains is to be assured. GRA

N86-24188# Naval Ocean Systems Center, San Diego, Calif.
THE EFFECTS OF BIS (TRI-N-BUTYLTIN) OXIDE ON THREE SPECIES OF MARINE PHYTOPLANKTON Final Technical Report, Jun. - Jul. 1982
S. M. Salazar May 1985 19 p
(DA Proj. Z08-29; DA Proj. ZR0-0001)
(AD-A162115; NOSC/TR-1039) Avail: NTIS HC A02/MF A01 CSCL 07/2

The effects of three concentrations of bis (tri-n-butyltin) oxide (TBTO) 1.5, 3.0, and 6.0 ppb) on three species of marine phytoplankton were assessed. Parameters measured were in vivo fluorescence and DCMU induced fluorescence. Fluorescence ratios were calculated from these values. The effects of TBTO exposure varied considerably from species to species. Gymnodinium splendens was the most sensitive, affected by all concentrations of TBTO. Dunaliella sp. demonstrated inhibition of growth at 3.0 and 6.0 TBTO after 3 days. No measurable effects were detected for Phaedactylum tricornutum at any of the TBTO exposures. These data indicate the effect of TBTO on marine phytoplankton may be species specific. GRA

N86-24189# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
THE EFFECTS OF KETAMINE ON RHESUS MONKEY SKELETAL DYNAMICS
Kristin N. Swenson, K. C. Smith, Clarence M. Oloff, and Marvin E. Souder Sep. 1985 52 p
(AF Proj. 723-1)
(AD-A162848; AAMRL-TR-85-060) Avail: NTIS HC A04/MF A01 CSCL 06/15

Four young male Rhesus monkeys were exposed to intramuscular injections of ketamine anesthetic (15 mg/kg) on eight selected days of a 28 day experiment. The subjects were dosed with bone labeling compounds to determine the effect ketamine had on bone modeling/remodeling dynamics. Trabecular bone sections of T sub 9 and L sub 4, and cortical bone sections of proximal femur and midshaft femur were used for histomorphometric analysis. Urine creatinine and calcium, and serum alkaline phosphatase and calcium levels were determined. Vertebral centrum compression tests were conducted on selected thoracic and lumbar levels. Stiffness, ultimate load and modulus showed significant increases in the ketamine exposure group. The results of the trabecular histomorphometry showed a possible increase in mineralization lag time or slower mineralization. Cortical bone histomorphometry could indicate activation of the skeletal system. The experimental results lead to the conclusion that something affected the mechanical strength parameters and the bone remodeling dynamics of the ketamine exposure group. It is unclear as to whether these differences are strictly due to ketamine as stress and age difference were other influencing factors. GRA

N86-24190# California Univ., Berkeley. Lawrence Berkeley Lab.
BIOLOGICAL EFFECTS AND PHYSICAL SAFETY ASPECTS OF NMR IMAGING AND IN VIVO SPECTROSCOPY
T. S. Tenforde and T. F. Budinger Aug. 1985 60 p refs Presented at the American Association of Physicists in Medicine Summer School, Portland, Ore., 4 Aug. 1985
(Contract DE-AC03-76SF-00098)
(DE86-002966; LBL-20053; CONF-8508145-1) Avail: NTIS HC A04/MF A01

An assessment is made of the biological effects and physical hazards of static and time-varying fields associated with the NMR devices that are being used for clinical imaging and in vivo spectroscopy. A summary is given of the current state of knowledge concerning the mechanisms of interaction and the bioeffects of these fields. Additional topics that are discussed include: (1) physical effects on pacemakers and metallic implants such as aneurysm clips, (2) human health studies related to the effects of exposure to nonionizing electromagnetic radiation, and (3) extant guidelines for limiting exposure of patients and medical personnel to the fields produced by NMR devices. On the basis of information available at the present time, it is concluded that the fields associated with the current generation of NMR devices do not pose a significant health risk in themselves. However, rigorous guidelines must be followed to avoid the physical interaction of these fields with metallic implants and medical electronic devices. DOE

N86-24191# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany). Space Div.
STUDY OF BIOSAMPLE PRESERVATION, HANDLING, AND OBSERVATION FACILITIES Final Report
Paris ESA May 1985 199 p refs Prepared in cooperation with Brunel Univ., Uxbridge, England Original contains color illustrations
(Contract ESTEC-5655/83-NL-PR)
(ESA-CR(P)-2126) Avail: NTIS HC A09/MF A01

An autonomous facility for biology experiments in space, to be flown on platforms such as EURECA is proposed. It is a modular, multiuser facility, capable of 6 months automated operation. It includes an experiment area for specimen growth in 1 g and micro-g, sample storage and transport facilities, and observation and data processing units. Tests on breadboards of critical subsystems (culturing, workstation, containers, cameras) show the feasibility of the design. Author (ESA)

52 AEROSPACE MEDICINE

Includes physiological factors; biological effects of radiation; and weightlessness.

N86-24192* National Aeronautics and Space Administration, Washington, D.C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 283)
Apr. 1986 69 p
(NASA-SP-7011(283); NAS 1.21:7011(283)) Avail: NTIS HC A04 CSCL 06E

This bibliography lists 184 reports, articles, and other documents introduced into the NASA scientific and technical information system in March 1986. Author

N86-24193 Institut fuer Flugmechanik, Brunswick (West Germany).
THE EFFECT OF HIGH FREQUENCY ELECTROMAGNETIC FIELDS ON HUMAN BEINGS (FREQUENCY RANGE BETWEEN 1 kHz AND 1000 GHz) [DIE WIRKUNG HOCHFREQUENTER ELEKTROMAGNETISCHER FELDER AUF DEN MENSCHEN (1kHz UND 1000 GHz)]
Adolf-Henning Frucht (Deutschen Zentralinstituts fuer Arbeitsmedizin, Berlin-Lichtenberg, West Germany), Norbert Krause, Guenter Nimtz (Technische Univ., Berlin), and Hans Schaefer 1984 128 p refs In GERMAN
Avail: Issuing Activity

The biological effects of high frequency electromagnetic fields were investigated to provide information for industrial safety personnel. The high frequency radiation problem is described. Medicinal and technical applications of high frequency electromagnetic fields are presented. The interactions between high frequency electromagnetic waves and matter are explained. Health problems due to these fields are depicted. Diathermy as a source of danger

is discussed. A case of death after extreme exposure to radar radiation is given. Tasks and possibilities for epidemiological research are presented. It is concluded that health damage due to high frequency electromagnetic fields do not occur as long as the known power thresholds are not exceeded. Author (ESA)

N86-24194# Ohio State Univ., Columbus.
OPTICAL AND EVENT-DURATION VARIABLES AFFECTING SELF-MOTION PERCEPTION Interim Paper Jan. 1984 - Apr. 1985
Dean H. Owen Nov. 1985 198 p
(Contract F33615-83-K-0038)
(AD-A161836; AFHRL-TP-85-23) Avail: NTIS HC A09/MF A01 CSCL 01/4

Four experiment sections are included in this paper. The first pair of experiments investigated the usefulness of optical flow acceleration in detecting descent. When sink rate and ground speed are constant, optical flow accelerates. Holding fractional loss in altitude constant throughout a descent event also holds flow rate invariant, eliminating flow acceleration as a potential source of information. Detection of descent was accomplished easily without flow acceleration, and it was found that at least one of the remaining functional optical variables specifying fractional loss in altitude must be highly salient. Also, the effect of optical texture density was optimal when linkages with other relevant variables were taken into account. The third experiment compared eyeheight and ground-unit size as metrics for global optical information specifying descent. Given that flow acceleration is not an essential source of information, the study focused on eyeheight-scaled change in optical display and ground-unit-scaled change in optical density as functional specifiers of fractional loss in altitude. The fourth experiment investigated the interation between global optical flow rate and duration of a constant-speed preview period. Of particular interest was the possibility that preview periods of different durations would differentially favor or interfere with sensitivity given particular optical conditions, e.g., different flow rates. GRA

N86-24195# Defence and Civil Inst. of Environmental Medicine, Downsview (Ontario).
THE ENERGY COST OF COMBAT ENGINEER TASKS
W. S. Myles and T. T. Romet Aug. 1985 20 p
(AD-A161861; DCIEM-85-R-31) Avail: NTIS HC A02/MF A01 CSCL 06/19

Canadian combat engineers performed abatis (blocking a road by falling trees), minelaying and road cratering for 8 hours each day on four consecutive days. Energy expenditure was estimated from heart rate continuously recorded using the VITALOG personal monitoring system (PMS-8). The average heart rates were below 120 bpm for all three combat engineer tasks indicating that, for these subjects, energy expenditure did not exceed 35 to 40% of their VO2max. Since abatis, minelaying and cratering are considered to be the most physically demanding tasks performed by combat engineers, it seems safe to conclude that the average energy expenditure for sustained operations will be at, or below, this level. This experiment also provided an opportunity to evaluate the PMS-8 as a means of collecting physiological data in a nonintrusive manner during military maneuvers. The system proved to be very robust, reliable and, because data collection is continuous, ideal for intermittent work of varying intensity. In addition, the PMS-8 appears to have considerable potential as a means of monitoring the effect of sleep deprivation and fatigue on the work/recovery cycle in sustained operations. Author (GRA)

N86-24196# Federal Aviation Administration, Washington, D.C. Office of Aviation Medicine.
DRUGS OF ABUSE IN AVIATION FATALITIES. 1: MARIJUANA
Delbert J. Lacefield, Patricia A. Roberts, and Paula M. Grape Aug. 1985 6 p
(AD-A161911; DOT/FAA/AM-85/8) Avail: NTIS HC A02/MF A01 CSCL 06/15

Isopropyl alcohol swabs taken from the oral cavities of pilots killed in general aviation accidents were analyzed for marijuana by the modified Duquenois-Levine test. During the 2-year period from October 1982 through September 1984, 289 pilot fatalities (of 809 sampled for other toxicological reasons) were sampled for marijuana; a positive test indicated the recent use of marijuana. Six of the pilots' samples (2.1%) were positive. GRA

N86-24197# Army Research Inst. of Environmental Medicine, Natick, Mass.
ENVIRONMENTAL STRESS AFTER ATROPINE TREATMENT
Margaret A. Kolka, Lou A. Stephenson, and Richard R. Gonzalez Oct. 1985 23 p
(DA Proj. 3M2-63764-D-995)
(AD-A161923) Avail: NTIS HC A02/MF A01 CSCL 06/15

Atropine administration resulted in higher skin temperatures in both sensible and insensible environments and a higher core temperature in the hot environment, due to the reduction in whole body sweating. The effect of heat storage (significantly higher after atropine) was shown to be greater in the hot environment due to inadequate sweat secretion for subsequent evaporative cooling. In the warm environment, enhanced skin blood flow resulted in more effective thermoregulation. The results suggest that exercise in the heat can be accomplished during environmental stress at warm temperatures after atropine treatment.
Author (GRA)

N86-24198# Army Research Inst. of Environmental Medicine, Natick, Mass.
RESPIRATORY RESPONSE AND MUSCLE FUNCTION DURING ISOMETRIC HANDGRIP EXERCISE AT HIGH ALTITUDE
Richard L. Burse, Allen Cymerman, and Andrew J. Young 15 Jul. 1985 33 p
(AD-A162003; USARIEM-M-2/86) Avail: NTIS HC A03/MF A01 CSCL 06/19

The purpose of this investigation was to determine if the hyperventilatory response to fatiguing isometric exercise at sea level could predict resting ventiliation and acute mountain sickness (AMS) at 4300 m altitude. Exercise consisted of four successive endurance handgrips held to complete fatigue at 40% of maximum isometric handgrip strength (MHS). There was no relationship between the magnitude or pattern of exercise-induced hyperventiliation at sea level and the severity of AMS later at altitude. Sea level hyperventilatory response was not predictive of resting ventilation at altitude. Altitude exposure progressively increased both the incidence and magnitude of the hyperventilatory response to exercise and prolonged it for 60 to 90 s into the recovery period, providing support for the central command theory of ventilatory control during isometric exercise. MHS was significantly increased at altitude, by 11% on day 2 and 16% on day 6. Endurance times to fatigue were reduced, but not always significantly so. GRA

N86-24199# Illinois Univ., Chicago. Chicago Circle Dept. of Bioengineering.
REMOTE SENSING OF BODY SIGNS AND SIGNATURES Final Report, 1 Aug. 1982 - 30 Sep. 1985
James C. Lin and Karen H. Chan Oct. 1985 82 p
(Contract N00014-82-C-0659)
(AD-A162106; BES-5) Avail: NTIS HC A05/MF A01 CSCL 17/9

This report describes the development of a microprocessor-based remote sensing system for noncontact detection of heart rate and respiration. Low power sinusoidal microwave signal at a frequency of 10.525 GHz is generated by a Gunn diode oscillator in an integrated Doppler transceiver. A standard gain horn is used to direct the microwave energy to the chest of a subject at a distance of a few centimeters. Since movements associated with the contraction of the heart and expansion of the lungs are translated into motions of the chest wall, the Doppler microwave reflected from the chest is processed to yield information on the frequency and regularity of these cardiopulmonary events. The microprocessor-based battery-powered system is designed to provide continuous operation for approximately one hour. It allows selection of heart rate or respiration to be displayed on a 3-digit

LCD. An analog output jack is provided for oscilloscope display or chart recording. The design range of heart rates is from 40 to 200 beats per minute and that for respiration is from 3 to 30 breaths per minute. The signal acquisition times for heart rate and respiration determinations are 12 and 48 seconds. respectively. GRA

N86-24200# Illinois Univ., Urbana-Champaign. Inst. of Aviation.
ANTIEMETIC DRUGS AND PILOT PERFORMANCE Interim Report, Feb. 1983 - Feb. 1984
Henry L. Taylor, John A. Dellinger, Martha H. Weller, Bruce C. Richardson, and Fred C. Hyman Nov. 1985 44 p Prepared in cooperation with Michigan Univ., Ann Arbor
(Contract F33615-83-K-0612)
(AD-A162109; USAFSAM-TR-84-52) Avail: NTIS HC A03/MF A01 CSCL 06/15

This study evaluated the effects on human performance of three antiemetic drugs. The effects on pilot performance in a flight simulator were determined using the commonly prescribed dosages, standardized for a 70 kg person, of thiethylperazine (10 mg), promethazine hydrochloride (25 mg) cimetidine (300 mg), and a placebo control. Two tasks, a two-dimensional tracking task which part of an instrument landing system (ILS) approach and the Sternberg choice reaction time task, were used to generate pilot performance data. A Latin square design was used to balance treatment order effects, and each subject received each treatment condition. Log root mean square (RMS) deviation values, computed from the simulator flight data (altitude straight and level, altitude turning, localizer (lateral) tracking, glideslope (vertical tracking) were used in a multivariate analysis of variance to test the main effects. An approximate F-test, based on Wilk's criterion, resulted in $F(12,87) = 2.47$, ($P < 0.0008$) for the treatment main effect (drug). Univariate analyses resulted in a significant drug main effect on two primary task variables--altitude straight and level and localizer tracking. Contrasts between the three antiemetic drugs and the placebo were used to test the hypothesis of no significant difference between treatment pairs. The contrasts between promethazine hydrochloride and the control were significant for altitude straight and level and for glideslope tracking. The other contrasts were not significant except for the control-thiethylperazine contrast for the localizer tracking variable. GRA

N86-24201# Federal Aviation Administration, Washington, D.C. Office of Aviation Medicine.
CHARACTERISTICS OF MEDICALLY DISQUALIFIED AIRMAN APPLICANTS IN CALENDAR YEARS 1982 AND 1983
Shirley J. Dark Sep. 1985 23 p
(AD-A162209; DOT/FAA/AM-85/9) Avail: NTIS HC A02/MF A01 CSCL 06/5

This study presents comprehensive data reflecting pertinent denial rates with respect to the medical and general attributes of those airmen denied medical certification in calendar years 1982 and 1983. The study updates previously reported data with respect to medical certification denials. The denial data were obtained from computer files as of July 1, 1983, for calendar year (CY) 1982 applicants and July 1, 1984, for CY 1983 applicants. The data were summed for the 2 calendar years to provide a larger group for comparison with the December 31, 1982, active airman population, the midpoint population date for the denied applicant group. The annual denial rate based on the airman applicants is 6.2 per 1,000 airmen. By class of certificate applied for, the annual denial rate per 1,000 applicants is 3.3 for first class, 3.8 for second class, and 8.6 for third class. As anticipated, general aviation and new applicants contribute greatly to total denials. The most significant causes for denial (regardless of class applied for) are cardiovascular, the miscellaneous pathology category (endocrinopathies, disqualifying medications, and administrative denials), neuropsychiatric, and at a substantially lower level, eye pathology. The updated data on medically disqualified applicants are consistent with expectations and previous findings, with cardiovascular diseases still the number one cause for denial. GRA

N86-24202# Army Research Inst. of Environmental Medicine, Natick, Mass.
EFFECTS OF WEARING NBC (NUCLEAR, BIOLOGICAL AND CHEMICAL) PROTECTIVE CLOTHING IN THE HEAT ON DETECTION OF VISUAL SIGNALS
John L. Kobrick and Lynn A. Sleeper Feb. 1985 26 p
(DA Proj. 3M1-61102-BS-10)
(AD-A162321; USARIEM-T7/85) Avail: NTIS HC A03/MF A01 CSCL 06/16

Sensitivity for detection of visual signals distributed at various locations throughout the visual field was studied in 16 male subjects during degrees of ambient heat exposure (91F/61%RH; 70F/35%RH; 55F/35%RH), in combination with and without wearing of the Army NBC protective clothing system (MOPP-IV). Response time for signal detection increased systematically and significantly with peripheralization of stimulus locations, was most impaired in the superior and inferior visual field areas, and least affected along the horizontal axis area. The data support previous results obtained using this task. Both the heat and the heat+MOPP-IV exposure conditions produced highly significant systematic increases in response time to all signals; the worst performance occurred under the heat+MOPP-IV combination. Implications for visual performance while wearing chemical protective gear are discussed.GRA

N86-24203# Army Research Inst. of Environmental Medicine, Natick, Mass.
AN EVALUATION OF TESTS OF ANAEROBIC POWER
John F. Patton and Andrew Duggan Dec. 1985 22 p
(AD-A162826; USARIEM-M7/86) Avail: NTIS HC A02/MF A01 CSCL 06/16

The objectives of this study were to examine the relationship between two laboratory tests of anaerobic power (AnP) and to compare these tests to field measures of AnP. Fifteen Soldiers, aged 20 to 34 yrs, performed: (1) a 30S maximal cycle ergometer test (Wingate test, WT); (2) a 60S isokinetic knee extension test (isokinetic endurance test, IET); (3) a 50m spring; (4) a 200m sprint; and (5) the Margaria stairclimb test. Significant correlations ranging from 0.52 to 0.76 were found between the WT and IET for peak and mean values of power and torque, respectively. Indices from both these tests also correlated significantly with the field tests of AnP. The best single index was mean power from the WT which had correlations of -0.79, -0.82, and 0.74 with the 50m and 200m sprint times and the Margaria test, respectively. The data suggest that both the WT and IET represent valid laboratory tests for evaluating high-intensity short-term exercise in which the muscle is primarily dependent upon anaerobic processes for energy release. Author (GRA)

N86-24204# IIT Research Inst., Chicago, Ill.
EXTREMELY LOW FREQUENCY (ELF) COMMUNICATIONS SYSTEM BIO-EFFECTS LIBRARY DEVELOPMENT Final Technical Report, Mar. - Oct. 1985
M. M. Abromavage, J. J. English, L. M. Kudia, and M. S. MacIntyre Oct. 1985 255 p
(Contract N00039-84-C-0070)
(AD-A162839; IITRI-E06549-21) Avail: NTIS HC A12/MF A01 CSCL 06/3

The professional literature published and available since August 1984 on the biological, ecological and health effects from exposure to Extremely Low Frequency (ELF) electromagnetic fields is compiled alphabetically by principal author. Each of the 485 citations is categorized according to electromagnetic field characteristics. Key biological and engineering terms are provided, and species of interest are identified. Author (GRA)

N86-24205# IIT Research Inst., Chicago, Ill.
ELF (EXTREMELY LOW FREQUENCY) BIOLOGICAL EFFECTS LITERATURE DATA BASE MANAGEMENT SYSTEM Final Report
John J. English and Linda M. Kudia Oct. 1985 44 p
(Contract N00039-84-C-0070)
(AD-A162900; IITRI-E06549-20) Avail: NTIS HC A03/MF A01 CSCL 09/2

Described are the functions and operation of the ELF biological effects literature data base management system. It covers functional requirements, system implementation, data base description, system operations, and detailed procedures. The system utilizes an IBM PC/XT computer and dBASE-III software. GRA

N86-24206# Naval Health Research Center, San Diego, Calif.
CHANGES IN FITNESS AND SHIPBOARD TASK PERFORMANCE FOLLOWING CIRCUIT WEIGHT TRAINING PROGRAMS FEATURING CONTINUOUS OR INTERVAL RUNNING Final Report
E. J. Marcinik, J. A. Hodgdon, C. E. Englund, and J. J. OBrien Aug. 1985 18 p
(AD-A163110; NAVHLTHRSCHC-85-33) Avail: NTIS HC A02/MF A01 CSCL 05/9

This investigation compared physical fitness and work performance changes following participation in circuit weight training regimes featuring either interval or continuous running programs. Results indicated that participation in the circuit weight training/run regimes was associated with differential changes in fitness but not shipboard work performance. Furthermore, the association between training induced fitness gains and relative improvement in job performance appeared to be specific to the task modelled. Important predictors of criterion job performance included measures of both upper and lower torso muscular strength. Regression analyses yielded the following prediction equation: Composite shipboard performance(s) = 194.15097-1.59492 (arm curl)-, 18369 (leg press) r=0.74. GRA

N86-24207# Naval Health Research Center, San Diego, Calif.
L-TRYPTOPHAN ADMINISTERED TO CHRONIC SLEEP-ONSET INSOMIACS: LATE-APPEARING REDUCTION OF SLEEP LATENCY Final Report, Dec. 1980 - Nov. 1985
Cheryl L. Spinweber 1 Nov. 1985 19 p
(AD-A163115; NAVHLTHRSCHC-85-42) Avail: NTIS HC A02/MF A01 CSCL 06/16

The effects of 3 g 1-tryptophan on sleep, performance, arousal threshold, and brain electrical activity during sleep were assessed in 20 male, chronic sleep-onset insomniacs (mean age 20.3 + or - 2.4 years). Following a sleep laboratory screening night, all subjects received placebo for 3 consecutive nights (single-blind), 10 subjects received 1-tryptophan and 10 subjects received placebo on 2 withdrawal nights (single-blind). There was no effect of 1-tryptophan on sleep latency during the first 3 nights of administration. On the 4th-6th nights of administration, sleep latency was significantly reduced. Unlike benzodiazepine hypnotics, 1-tryptophan did not alter sleep stages, impair performance, elevate arousal threshold, or alter brain electrical activity during sleep. GRA

N86-24208# Harvard Univ., Cambridge, Mass. Energy and Environmental Policy Center.
ANALYSIS OF HEALTH EFFECTS RESULTING FROM POPULATION EXPOSURES TO AMBIENT PARTICULATE MATTER. HEALTH AND ENVIRONMENTAL EFFECTS DOCUMENT, 1985
J. D. Spengler Sep. 1985 77 p refs
(Contract DE-AC02-81EV-10731)
(DE86-002161; DOE/EV-10731/5) Avail: NTIS HC A05/MF A01

Findings from our recent epidemiologic analyses reported here indicate variations in ambient fine particle mass (d sub a < 2.5 (MU)m toxic substances include arsenic, cadmium, sulfur, and carbonaceous compounds). SO4 sup = mass are more important to public health than variations in the levels of particle mass measures which also include coarse particles (d sub a > 2.5 (MU)m). Sulfates and FP mass wsere often very significant predictors of variations in residual mortality throughout the US, even after controlling for socio-economic factors. Analysis of 12 years of daily mortality and air pollution in New York City showed that aerosol extinction coefficient (b sub ext), a good surrogate for fine particles, is significantly associated with observed mortality. DOE

N86-24209# Oak Ridge National Lab., Tenn.
FIBEROPTICS IMMUNOFLUORESCENCE SPECTROSCOPY FOR CHEMICAL AND BIOLOGICAL MONITORING
T. Vo-Dinh, G. D. Griffin, K. R. Ambrose, M. J. Sepaniak, and B. J. Tromberg 1985 17 p Presented at the 10th International Symposium on Polynuclear Aromatic Hydrocarbons, Columbus, Ohio., 21 Oct. 1985 Prepared in cooperation with Tennessee Univ., Knoxville
(Contract DE-AC05-84OR-21400)
(DE86-002239; CONF-851068-2) Avail: NTIS HC A02/MF A01

The feasibility of the fluoroimmuno-sensor (FIS) detection of IgG proteins tagged with fluorescein isothiocynate was demonstrated. In view of the biotechnological advances in the area of monoclonal antibodies and the production of anti-hapten sera it is believed that fiberoptics-based FIS could be generally useful in a wide spectrum of biochemical and clinical analyses. Specifically, the FIS could be employed in the assessment of an individual's exposure to chemical PAH carcinogens, response to drug therapy, or in the characterization of naturally occurring biochemicals. For example, studies investigating the presence of carcinogens and carcinogen-DNA adducts in tissues and body fluids could be performed with the FIS using immunochemical techniques. An integration of fluorescence immunoassay principles with laser-based fiberoptics systems is planned in order to develop FIS which should be capable of providing reliable analytical data for such studies. DOE

N86-24210# Los Alamos National Lab., N. Mex.
EFFECTS: DOCUMENTATION AND VERIFICATION FOR A BEIR 3 CANCER RISK MODEL BASED ON AGE, SEX AND POPULATION DYNAMICS FOR BIOTRAN
W. J. Wenzel and A. F. Gallegos Sep. 1985 108 p refs
(Contract W-7405-eng-36)
(DE86-003285; LA-10371-MS) Avail: NTIS HC A06/MF A01

The computer simulation code EFFECTS is coupled with the radionuclide uptake and environmental transport strategies of the BIOTRAN code to predict cancer risks and deaths in a dynamic human population. Total mortalities due to all causes are incorporated with projected radiation-induced cancer mortalities caused by all previous chronic or acute radiation exposures of the population as a function of age and sex. Superpositioning radiation-induced cancer mortalities on current total mortalities in each age group allows a realistic and dynamic estimate of cancer risks for complex radiation exposure scenarios. EFFECTS was developed on the CDC 7600 and can be executed on the Cray computer system at Los Alamos National Laboratory. EFFECTS can simulate the upper boundary of cancer risk estimates where population exposures occur over many years and where organ burdens are integrated over the lifetime of the individual. This report gives new insight on age-specific cancer risks. As part of the code verification, the simulated impacts to a small population from natural background uranium and an accidental release of airborne plutonium are compared. For the long-term continuous exposure to natural background uranium, the impact to the population is very small (2 x 10(-6) to 7 x 10(-6) deaths/10,000 people) with young adults receiving the largest bone doses and risks. For the long-term intakes following a simulated accidental air release of plutonium, young teenagers receive the highest bone doses while young adults receive the largest risk. Simulating these two scenarios, using BIOTRAN/HUMTRN/EFFECTS, illustrates sufficient resolution to predict the age/sex-specific response from human populations from contaminants in our environment. DOE

N86-24211# Health Effects Research Lab., Research Triangle Park, N. C.
USING ASHFORD'S GENERAL MODEL TO AID IN THE UNDERSTANDING OF A PESTICIDE'S NEUROTOXIC EFFECT THROUGH PESTICIDE-DRUG MIXTURE EXPERIMENTS
D. J. Svendsgaard and K. M. Crofton Nov. 1985 15 p Prepared in cooperation with North Carolina Univ., Chapel Hill
(PB86-130028; EPA-600/D-85-241) Avail: NTIS HC A02/MF A01 CSCL 06T

A framework for interpreting the joint action of mixtures of drugs is discussed. The concepts are applied to the situation in which the mechanism of three drugs are fairly well understood and mixtures of pesticides and drugs are studied to aid in the understanding of the mechanism of certain types of pesticides. Laboratory data are fit by nonlinear regression to suggested models. The conclusions drawn from fitting these models and the implication of the design of experiments for further studies are discussed. GRA

N86-24212# Resources for the Future, Inc., Washington, D. C.
EXECUTIVE SUMMARY: AMBIENT OZONE AND HUMAN HEALTH: AN EPIDEMIOLOGICAL ANALYSIS Final Report
P. R. Portney and J. Mullahy Aug. 1985 23 p
(Contract EPA-68-02-3583)
(PB86-114089; EPA-450/5-85-005D) Avail: NTIS HC A02/MF A01 CSCL 06T

The report by the Office of Air Quality Planning and Standards of the Environmental Protection Agency is the executive summary of an analysis of the relationship between ozone and human health benefits. GRA

N86-24213# Resources for the Future, Inc., Washington, D. C.
AMBIENT OZONE AND HUMAN HEALTH: AN EPIDEMOLOGICAL ANALYSIS, VOLUME 3 Final Report
P. R. Portney and J. Mullahy Jun. 1985 180 p refs
(Contract EPA-68-02-3583)
(PB86-114105; EPA-450/5-85-005C) Avail: NTIS HC A09/MF A01 CSCL 06F

The report is the third volume by the Air Quality Planning and Standards Office of EPA of an analysis of the relationship between ozone and human health benefits. GRA

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N86-24214# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision.
A METHODOLOGY FOR THE ANALYSIS AND DESIGN OF HUMAN INFORMATION PROCESSING ORGANIZATIONS Ph.D. Thesis
Kevin L. Boettcher Sep. 1985 199 p
(Contracts N00014-77-C-0532; N00014-84-K-0519)
(AD-A162083; LIDS-TH-1501) Avail: NTIS HC A09/MF A01 CSCL 05/10

The design of human organizations in which members perform routine tasks under the pressure of time is considered, particularly the problem of where and how in the design process to take into account human behavior and limitations. A three-phase design approach is suggested. In the first phase, the impact of human characteristics is neglected and attention is focused on aspects of organization structure that are external to individual members. In the second phase, implementations for these decision rules are devised and models of actual human behavior and induced workload for the tasks established for each member are developed. The descriptions are determined as a function of parameters that relate to features of the task set-up and to the options provided to the member for accomplishing his task. A final design phase places these parameters for best organization performance and in view of the workload limitations of individual members. The result is an organization design. The three-phase approach has been formalized as a multi-step methodology. Discussion and illustration is given for each design step. In addition, the methodology is exercised on a specific problem and the resulting organization design has been built. Operation of the organization has been tested under several conditions and experimentally observed results match those predicted for the design, which in turn supports the validity of the design approach. GRA

N86-24215# Navy Personnel Research and Development Center, San Diego, Calif.
DEVELOPMENT OF A COMPUTER-MANAGED READINESS ASSESSMENT SYSTEM Final Report, Jul. 1982 - Sep. 1984
W. F. Thode and P. G. Buletza Dec. 1985 55 p
(AD-A162931; NPRDC-TR-86-8) Avail: NTIS HC A04/MF A01 CSCL 05/9

Readiness of operational units, especially Fleet Air Reconnaissance Squadron TWO (VQ-2), is difficult to assess, particularly during operational cycles when the units are fulfilling their missions. This effort was conducted to develop a readiness training assessment system for VQ-2 to provide accurate, timely, and efficient assessments of the operational readiness of aircrew personnel while maintaining the highest possible state of readiness to perform the squadron's mission. The readiness training system for maintaining readiness and training data for VQ-2 aircrew personnel consists of: (1) a matrix for the EP-3E and the EA-3B aircraft of all the events that affect the readiness of the personnel assigned to the 10 crew positions in the EP-3E and the 5 crew positions in the EA-3B for each of the four VQ-2 mission area; (2) a computer-managed system to enter, process, store, and produce the readiness training manual that contains all VQ-2's references on training and readiness. Author (GRA)

N86-24546*# Lambuth Coll., Jackson, Tenn. Dept. of Physics, Mathematics and Computer Science.
A PRELIMINARY STUDY OF FLAT-PANEL DISPLAYS
Kenneth E. Yancey *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 16 p refs (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 09C

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N86-24216 Kansas State Univ., Manhattan.
STOCHASTIC MODELS OF MAN–MACHINE SYSTEM EFFECTIVENESS Ph.D. Thesis
Kang Won Lee 1985 360 p
Avail: Univ. Microfilms Order No. DA8528018

A human performance reliability model was developed to introduce the human operator effect into the system effectiveness model. The model can predict quantitatively how much the human aspects of the man-machine system contribute to the system unreliability. Mission effectiveness models that provide a realistic measurement of system effectiveness are presented. It depicts interrelationships between the components of the mission system and shows a way to properly integrate the human operator into mission effectiveness. For situations in which there are too many computational difficulties in developing the models, the simulation approach is more practical than the analytical approach. To demonstrate the sensitivity of the probabilistic assumptions for the system variables to the mission effectiveness, a robustness test is performed. To identify system variables sensitive to mission effectiveness can be obtained by allocating more effort to estimating these variables. The models developed will lead to a more valid effectiveness analysis output and provide a useful tool for consistent system evaluation. Dissert. Abstr.

N86-24217*# Essex Corp., Huntsville, Ala. Space Systems Group.
THE SYSTEM INTEGRATION AND VERIFICATION TESTING OF AN ORBITAL MANEUVERING VEHICLE FOR AN AIR BEARING FLOOR Final Report
Nicholas L. Shields, Jr., Mary Frances Martin, Karen R. Paulukaitis, John W. Haslam, Jr., and David E. Henderson 22 Feb. 1986 125 p refs

(Contract NAS8-35636)
(NASA-CR-178350; NAS 1.26:178350; H-86-02) Avail: NTIS HC A06/MF A01 CSCL 05H

The teleoperator and Robotics Evaluation Facility (TOREF) is composed of a 4,000 square foot precision air bearing floor, the Teleoperator Motion Base, the Target Motion and Support Simulator, the mock-ups of the Hubble Space Telescope, Multi-mission Modular Spacecraft, and the Orbital Maneuvering Vehicle (OMV). The TOREF and its general capabilities to support the OMV and other remote system simulations; the facility operating procedures and requirements; and the results of generic OMV investigations are summarized. B.G.

N86-24218# Army Research Inst. of Environmental Medicine, Natick, Mass.
EFFECT OF HEAT AND CHEMICAL PROTECTIVE CLOTHING ON COGNITIVE PERFORMANCE Final Report
Bernard J. Fine and John L. Kobrick Nov. 1985 27 p
(AD-A162001; USARIEM-M-4/86) Avail: NTIS HC A03/MF A01 CSCL 06/17

This study examined the effects of heat on the sustained cognitive performance of sedentary soldiers clad in chemical protective clothing, Twenty males trained for 2 weeks on selected military tasks. Then, they performed the tasks for 7-hour periods on 4 successive days in hot (32.8C.,61%rh) and normal (21. 1C35%rh) conditions, with and without protective clothing. After 4 to 5 hours in the heat wearing protective clothing, the cognitive performance of the group began to deteriorate markedly. By the end of 7 hrs. of heat, increases in % group error on investigator-paced tasks ranged from 17% to 235 over control conditions. Virtually all of the decrements were due to increases in errors of omission. The productivity of the group on a self-paced task (map plotting) diminished by approximately 40% from control conditions after 6 hrs. in the heat in protective clothing; accuracy of plotting was not markedly affected. GRA

N86-24219# Army Research Inst. of Environmental Medicine, Natick, Mass.
EFFECTIVENESS OF AN AIR-COOLED VEST USING SELECTED AIR TEMPERATURE AND HUMIDITY COMBINATIONS
Nanvy A. Primental, Henry M. Cosimini, Michael N. Sawka, and C. B. Wenger Nov. 1985 25 p
(AD-A162026; USARIEM-M5/86) Avail: NTIS HC A02/MF A01 CSCL 06/17

We evaluated the effectiveness of an air-cooled vest in reducing thermal strain when supplied with five different dry bulb (db) and dew point (dp) temperature combinations. The combinations were selected to determine minimal air conditioning requirements for various military vehicles. Four male soldiers attempted twelve, 300-min heat exposures (49 C db, 20 C dp) at metabolic rates of 175 and 315 W. They wore chemical protective clothing over the combat vehicle crewman uniform; on ten of the test days, they also wore the air-cooled vest. Air supplied to the vest ranged from 20-27 C db, 7-18 C dp. Without the vest, endurance times were 118 min (175 W) and 73 min (315 W). Endurance times with the vest were 300 min (175 W) and 242-300 min (315 W). Rectal temperatures, heart rates and sweating rates were reduced dramatically with the air at the lower dry bulb temperature. We conclude that effective combinations of cooled and dehumidified air can be provided on military vehicles to reduce the crewmen's thermal strain, with minimized size and weight penalties. GRA

N86-24220# Naval Postgraduate School, Monterey, Calif.
THE DESIGN OF NATURAL LANGUAGE INTERFACES M.S. Thesis
Ioannis Kotrozos Sep. 1985 110 p
(AD-A162181) Avail: NTIS HC A06/MF A01 CSCL 05/8

One of the possible solutions to the problem of designing effective man-machine interfaces seems to be the use of natural languages. This thesis examines the principles of design of effective man-machine interfaces, the role of natural languages in achieving effective man-machine communication and the implementation issues and techniques for their use as interfaces. GRA

N86-24221# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
AN EXAMINATION OF THE LIFE SUPPORT EQUIPMENT DEVELOPMENT AND ACQUISITION PROCESS M.S. Thesis
Jeffrey J. Moyer Sep. 1985 66 p
(AD-A162241; AFIT/GSM/XPX/85S-24) Avail: NTIS HC A04/MF A01 CSCL 15/5

The process of life support equipment development and acquisition is examined. This research identified the how the present process works, and the problems of the process. The research was limited to the development and acquisition of life support equipment for tactical aircraft. However, most of the problems and steps of the process are shared by life support equipment programs for other users. The process was determined by referring to applicable regulations and interviewing people involved in the process. Problems were identified during interviews, and by examining the process as a whole. Seven problems are identified, of which five are considered correctable in the current defense acquisition framework. Four of the five problems deal with the management of the acquisition and development process, and combined indicate the lack of an integrated approach. Solutions were developed from suggestions obtained during the interviews and through qualitative analysis of the problems. An integrated solution is proposed in the recommendations. GRA

N86-24222# Naval Postgraduate School, Monterey, Calif.
HUMAN FACTORS ENGINEERING AND OPERABILITY IN THE DESIGN OF ELECTRONIC WARFARE SPACES ABOARD UNITED STATES NAVAL COMBATANTS M.S. Thesis
David J. Blauser, Jr. Sep. 1985 118 p
(AD-A162251) Avail: NTIS HC A06/MF A01 CSCL 17/4

The purpose of this thesis is to present and discuss a a method of assessing the effectiveness of a work space layout. In addition, this method will provide the framework for pinpointing those areas of layout design where redesign will be most cost effective. The objective is to address inefficiencies in the layout of warfare modules on U.S. Navy combatants. In particular, the Electronic Warfare Module on aircraft carriers is assessed due to the highly time-critical nature of electronic warfare. The method chosen in this thesis is a modification of two techniques of assessment: Integration Analysis and Mission Operability Assessment Technique (MOAT). The portions of these techniques used are Link Analysis, Task Analysis, and Operability Analysis. The application herein concludes that the EW Module layout design on the latest NIMITZ-class aircraft carriers was less than 40% effective in promoting mission accomplishment. GRA

N86-24223# Essex Corp., Westlake Village, Calif. Human Factors and Training Systems Group.
PERSON COMPUTER DIALOGUE: A HUMAN ENGINEERING DATA BASE SUPPLEMENT
Brian E. Shaw and Michael E. McCauley Jan. 1985 148 p
(Contract F33615-82-C-0513)
(AD-A163074; AFAMRL-TR-85-013) Avail: NTIS HC A07/MF A01 CSCL 09/2

This report was prepared as a Human Engineering Data Base Supplement to the Integrated Information for Designers (IPID) Engineering Data Compendium. It was specifically written to aid computer system designers. The body of literature on person-computer dialogue has been gathered and organized into an integrated format. Major topic areas include conceptual comparisons of person-computer dialogue, models for evaluation of dialogue systems, unique considerations of specific user groups, and specific user-system dialogue design considerations. These major areas are subdivided into succinct discussions of highly focused design considerations. Each discussion of design considerations includes a general description, statement of applications, constraints, and key references in addition to the graphic/tabular formatted design guidelines. An extensive bibliography of literature on person-computer dialogue is included. GRA

N86-24527*# Mississippi State Univ., Mississippi State. Dept. of Chemical Engineering.

STANDARDIZATION OF CARBON-PHENOLIC COMPOSITE TEST METHODOLOGY
William B. Hall *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 27 p (For primary document see N86-24507 14-80) Avail: NTIS HC A99/MF E04 CSCL 11D

55 PLANETARY BIOLOGY

Includes exobiology; and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering.*

N86-24224*# National Aeronautics and Space Administration. Pasadena Office, Calif.
NEIGHBORHOOD COMPARISON OPERATOR Patent Application
Donald B. Gennery, inventor (to NASA) (JPL, Pasadena, Calif.) Filed 31 Dec. 1985 13 p
(Contract NAS7-918)
(NASA-Case-NPO-16464-1CU; NAS 1.71:NPO-16464-1CU; US-Patent-Appl-SN-615099) Avail: NTIS HC A02/MF A01 CSCL 09B

Digital values in a moving window are compared by an operator having nine comparators connected to line buffers for receiving a succession of central pixels together with eight neighborhood pixels. A single bit of program control determines whether the neighborhood pixels are to be compared with the central pixel or a threshold value. The central pixel is always compared with the threshold. The omparator output plus 2 bits indicating odd-even pixel/line information about the central pixel addresses a lookup table to provide 14 bits of information, including 2 bits which control a selector to pass either the central pixel value, the other 12 bits of table information, or the bit-wise logical OR of all nine pixels through circuit that implements a very wide OR gate. NASA

N86-24225*# National Aeronautics and Space Administration. Pasadena Office, Calif.
CONVOLVER Patent Application
Brian Wilcox, inventor (to NASA) (JPL, Pasadena, Calif.) Filed 31 Dec. 1985 14 p
(Contract NAS7-918)
(NASA-Case-NPO-16462-1CU; NAS 1.71:NPO-16462-1CU; US-Patent-Appl-SN-815106) Avail: NTIS HC A02/MF A01 CSCL 09B

A 3-by-3 convolver utilizes 9 binary arithmetic units connected in cascade for multiplying 12-bit binary pixel values P sub i which are positive or two's complement negative binary numbers by 5-bit magnitude (plus sign) weights W sub i which may be positive or negative. The weights are stored in registers including the sign bits. For a negative weight, the one's complement of the pixel value to be multiplied is formed at each unit by a bank of 17 exclusive or gates G sub i under control of the sign of the corresponding weight w sub i, and a correction is made by adding the sum of the absolute values of all the negative weights for each 3x3 kernel. Since this correction value remains constant as long as the weights are constant, it can be precomputed and stored in a register as a value to be added to the product PW of the first arithmetic unit. NASA

N86-24226# Naval Ocean Research and Development Activity, Bay St. Louis, Miss.
THE GEONAMES PROCESSING SYSTEM FUNCTIONAL DESIGN SPECIFICATION. VOLUME 4: ADVANCED SYMBOL PROCESSING Final Report
Gail Langran Mar. 1985 45 p
(AD-A161874; NORDA-101) Avail: NTIS HC A03/MF A01 CSCL 09/2

This report describes the Geonames Processing System attributes and serves as a basis for understanding between the user and the developer. The subsystems referred to are: Advanced Symbol Processing, Advanced Type Placement, Geographic Names Data Base, and Automated Alphanumeric Data Entry System. Contents: Introduction-Overview of Geonames Processing System: Advanced Symbol Processing Overview; Word Processing; Data Base Manipulation; Output Processing; Job Management; File Management; Processing Flow; Data Sets; Interfaces to Other Subsystems; Assumptions and Constraints; Performance Requirements; and Hardware Requirements. GRA

N86-24227# American Society for Engineering Education, Washington, D. C.
DESIGN OF GRAPHIC DISPLAYS IN COMPUTERIZED SYSTEMS Final Report, 1 Sep. 1984 - 1 Sep. 1985
Kevin Bennett 1 Sep. 1985 37 p
(Contract N00014-83-D-0689)
(AD-A161890) Avail: NTIS HC A03/MF A01 CSCL 09/2

The user's mental model of a computerized, perceptual database system was investigated in three experiments. The system consisted of a database of multidimensional sounds, command to search the database, and one of three separate displays (two graphic displays for training, an alpha-numeric display for testing). The graphic displays presented different conceptualizations of the database; training with a different graphic display was predicted to cause the formation of a different mental model of the system. The results of three experiments indicated that users trained with one graphic display identified two-dimensional sounds with significantly lower latency (Experiment 1) than users trained with the second graphic display. For three-dimensional sounds these findings with both displays this interaction disappeared (Experiment 3). The results indicate that display design can influence the user's mental model of a system and that this has implications for performance with the system. Author (GRA)

N86-24228# Yale Univ., New Haven, Conn. Dept. of Chemistry.
ALTERNATING DIRECTION METHODS ON MULTIPROCESSORS
S. L. Johnsson, Youcef Saad, and Martin H. Schultz Oct. 1985 15 p
(Contracts N00014-84-K-0084; N00014-84-K-0043)
(AD-A161973; YALEU/DCS/RR-382) Avail: NTIS HC A02/MF A01 CSCL 09/2

A new implementation of the Alternating Direction Method for solving parabolic partial differential equations on multiprocessors is proposed. A careful complexity analysis of these implementations shows that, contrary to what is generally believed, the method can be made highly efficient on parallel architectures by using pipelining and variations of the classical Gaussian elimination algorithm for solving tridiagonal systems. An earlier work showed that linear speedups could be obtained for moderate numbers of processors in a ring architecture. This paper discusses Extensions

to a large number of processors in a 2-D grid architecture and a hypercube are discussed. Author (GRA)

N86-24229# Defence Research Establishment Suffield, Ralston (Alberta).
PROPOSED IMPLEMENTATION OF A COMPUTER AIDED DESIGN AND DRAFTING (CAD/D) CAPABILITY AT DRES (DEFENCE RESEARCH ESTABLISHMENT SUFFIELD)
Steven G. Penzes Sep. 1985 36 p
(AD-A162006; DRES-SM-1111) Avail: NTIS HC A03/MF A01 CSCL 09/2

The feasibility of installing a CAD/D system at DRES is investigated with the constraints that the recommended system cost less than $150K (1982) and be a turnkey installation. The ANVIL 4000L software package, compatible with the recently acquired central computer, a Honeywell DPS8/70C, is recommended. GRA

N86-24230# Aerospace Corp., El Segundo, Calif. Electronics Research Lab.
GPIB INTERFACE AND TIMING GENERATOR FOR THE HEWLETT-PACKARD 2401C INTEGRATING DIGITAL VOLTMETER
Martin F. Bottjer, Walter A. Johnson, Tsutomu T. Mori, and Donald Y. Watanabe 30 Sep. 1985 38 p
(Contract F04701-83-C-0084)
(AD-A162189; TR-0084A(5925-08)-1; SD-TR-85-67) Avail: NTIS HC A03/MF A01 CSCL 14/2

GPIB interface logic and a timing generator for the Hewlett-Packard 2401C integrating digital voltmeter were designed, constructed, and checked out. This logic enables the control of the 2401C by a Hewlett Packard 9825T calculator. This hardware is described herein. Also described is software for a typical usage for the voltmeter, calculator, and interface system with a printer and plotter as outputting devices. GRA

N86-24231# Stanford Univ., Calif. Dept. of Computer Science.
GUIDON-WATCH: A GRAPHIC INTERFACE FOR VIEWING A KNOWLEDGE-BASED SYSTEM Technical Report
Mark H. Richer and William J. Clancey Aug. 1985 44 p
(Contract N00014-85-K-0305)
(AD-A162190; SU-STAN-CS-85-1068; KSL-85-20) Avail: NTIS HC A03/MF A01 CSCL 09/2

GUIDON-WATCH, a graphic interface that uses multiple windows and a mouse to allow a student to browse a knowledge base and view reasoning processes during diagnostic problem solving is described. Methods are presented for providing multiple views of hierarchical structures, overlaying results of a search process on top of static structures to make the strategy visible, and pictorially expressing evidence relations between findings and hypotheses. This work demonstrates the advantages of stating a diagnostic search procedure in a well-structured, rule-based language, separate from domain knowledge. A number of issues in software design are also considered, including the automatic management of a multiple-window display. Author (GRA)

N86-24232# Naval Postgraduate School, Monterey, Calif.
TENSOR FORMULATIONS FOR THE MODELLING OF DISCRETE-TIME NONLINEAR AND MULTIDIMENSIONAL SYSTEMS Ph.D. Thesis
Peter J. Lenk Sep. 1985 197 p
(AD-A162340; CR-84-1) Avail: NTIS HC A09/MF A01 CSCL 12/1

The modelling of nonlinear and multidimensional systems from input and/or output measurements is considered. Tensor concepts are used to reformulate old results and develop several new ones. These results are verified through non-trivial computer simulations. A generalized tensor formulation for the modelling of discrete-time stationary nonlinear systems is presented. Tensor equivalents of the normal equations are derived and several efficient methods for their solution are discussed. Conditions are established that ensure a diagonal correlation tensor so that a solution can be obtained directly without matrix inversion. Using a tensor formulation, a new proof of the Generalized Lattice Theory is obtained. Tensor extensions of the Levinson and Schur algorithms are presented. New two-dimensional lattice parameter models are derived. Using the tensor form of the Generalized Lattice Theory the 2-D multi-point error order-updates are decomposed into 0(N2) single point updates. 2-D extensions of the Levinson and Schur algorithms are given. The quarter plane lattice is considered in detail, first in a general form, then in forms which reduce the computational complexity by assuming shift-invariance. Based on the 2-D lattice, a new nonlinear lattice model is developed. The model is capable of updates in the nonlinear as well as time order. Author (GRA)

N86-24233# Spectra Research Systems, Inc., Vandenberg AFB, Calif.
FEASIBILITY STUDY FOR A STATIC AIRCRAFT FLIGHT Final Technical Report, Oct. 1984 - Jun. 1985
Charles H. Hightower 14 Jun. 1985 55 p
(Contract N61339-84-C-0069)
(AD-A163129; SRS0069-0001; NAVTRASYSCEN-85-C-0069) Avail: NTIS HC A04/MF A01 CSCL 09/2

The feasibility of embedding training software in modern flight aircraft to maintain pilot proficiency while parked was investigated. Candidate training scenarios critical to pilot performance were identified. Feasibility was demonstrated based on current and projected capabilities of the AYK-14 mission computers performing the weapons and navigation calculations in the Navy's F/A-18 Hornet. It was shown that the version 6 AYK-14 computer with dual single card processors (SCP's) would provide a suitable host for training software. The F/A-18 avionic and display systems are also shown to support the SAFES (Static Aircraft Flight Environment Simulator) concept. A number of candidate SAFES implementations are defined and one selected for feasibility demonstration remove fastener. Author (GRA)

N86-24234# Lawrence Livermore National Lab., Calif.
INSTALLATION OF THE PADL-2 SOLID MODELER ON THE CRAY-1
J. R. Kalibjian Aug. 1985 9 p
(Contract W-7405-eng-48)
(DE86-002841; UCID-20478) Avail: NTIS HC A02/MF A01

We describe in detail the method used to install the PADL-2 solid modeler on the CRAY-1 at Lawrence Livermore National Laboratory (LLNL), and document the solutions required to successfully implement two versions of this VAX native source code. Inadequate PADL-2 documentation and PADL-2's dependence on many non-standard FORTRAN features delayed bringing up Version 1.0. Additional problems resulted from little known quirks in LTSS system routines such as 8-bit character data losses (in CIVIC) on byte data transfers to subroutines and binary incompatibility between CIVIC and CFT logical variables and syntax conflicts with PRECOMP. We installed the second version, PADL-2/1.2, with much less difficulty because the code was cleaner and most implementation problems had already been identified. Yet, other problems were discovered such as CFT compiler differences from standard FORTRAN-77 and lack of LTSS support libraries for list directed and file I/O. Finally, modifications to the original Lexidata and Tektronix graphic interface routines let us generate: (1) color high-resolution, shaded pictures on the laboratory's Dicomed film recorder; (2) low-resolution black-and-white dithered pictures of shaded objects displayable on TMDS and RJET; and (3) wireframe pictures of parts also displayable on both TMDS and RJET. DOE

N86-24235# Societe Crouzet, Valence (France). Div. Aerospatial.
IMPLEMENTATION TECHNIQUES FOR LARGE ONBOARD MEMORY SYSTEMS Final Report [TECHNIQUES DE CONDITIONNEMENT POUR DE GRANDS SYSTEMES DE MEMOIRE DE BORD]
G. Menozzi, A. Bricard, and M. Lepertel Paris ESA Feb. 1985 83 p refs In FRENCH
(Contract ESTEC-4896/81-NL-HP)
(Rept-C.SE.MEMP.DS.002; ESA-CR(P)-2125) Avail: NTIS HC A05/MF A01

The preliminary analysis aimed to examine several technological solutions compatible with a short term space utilization. A leadless chip carrier module on multilayer ceramic support with a 3 Mbit memory capacity was selected and a chip and wire second solution was kept to provide a reference. The module dimensions are 278 by 163 mm and 11,6 mm depth. Mechanical and thermal studies were carried out giving a 200 Hz resonant frequency and 88 C junction temperature. The evaluation shows the aptitude for space utilization. A module was manufactured for electrical tests that were carried out at 2.5 MHz access frequency. The results permit the conception of memory systems working at up to 100 Mbits/sec. Author (ESA)

N86-24236# Ministerie van Sociale Zaken en Werkgelegenheid, s'Gravenhage (Netherlands).
STIMULATION OF COMPUTER SCIENCES Progress Report [INFORMATICASTIMULERING, VOORTGANGSRAPPORTAGE, SEPTEMBER 1985]
Sep. 1985 28 p In DUTCH
(Rept-19-158-No-1-2; B8575278) Avail: NTIS HC A03/MF A01

The progress made after 1.5 yr in the framework of the computer science stimulation plan is described. The purposes and financing of the plan are explained. The integration of the plan in the Dutch education system is presented. The management policy aims at the broadening of the market in the field of computer technologies. The applications of computer technologies in government services are described. Author (ESA)

N86-23838# National Bureau of Standards, Gaithersburg, Md. Electronic Instrumentation and Metrology Electrosystems Div.
DATA CONVERTER TEST METHODS
T. M. Souders *In its* Digital Methods in Waveform Metrology Oct. 1985 p 75-85 refs (For primary document see N86-23833 14-33)
Avail: NTIS HC A09/MF A01 CSCL 09B

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N86-24237*# Virginia Univ., Charlottesville. Dept. of Computer Science.
A SECOND GENERATION EXPERIMENT IN FAULT-TOLERANT SOFTWARE
J. C. Knight Mar. 1986 59 p refs
(Grant NAG1-511)
(NASA-CR-176723; NAS 1.26:176723; UVA/528235/CS86/102) Avail: NTIS HC A04/MF A01 CSCL 09B

The primary goal was to determine whether the application of fault tolerance to software increases its reliability if the cost of production is the same as for an equivalent nonfault tolerance version derived from the same requirements specification. Software development protocols are discussed. The feasibility of adapting to software design fault tolerance the technique of N-fold Modular Redundancy with majority voting was studied. B.G.

N86-24238# Cornell Univ., Ithaca, N.Y. School of Operations Research and Industrial Engineering.
TESTS FOR INITIALIZATION BIAS IN COMPUTER SIMULATION EXPERIMENTS
David Goldsman and Lee W. Schruben Dec. 1984 34 p Prepared in cooperation with Georgia Inst. of Tech., Atlanta
(Contract N00014-81-K-0037)
(AD-A161963; TR-J-84-16) Avail: NTIS HC A03/MF A01 CSCL 09/2

Although many of the rules for detecting and dealing with initialization bias in computer simulation experiments are easy to understand and implement, they are nonetheless heuristic. This paper uses the theory of standardized times series to construct tests which (under certain conditions) detect significant initialization bias in a process. Previous tests for initialization bias can be viewed as special cases of the general family of tests to be presented here. Author (GRA)

N86-24239# Washington Univ., Seattle.
A PRACTICAL APPLICATION OF LOTUS 1-2-3 (TRADEMARK) IN CONSTRUCTION MANAGEMENT M.S. Thesis
Kenneth Rachko 1985 103 p
(Contract N66314-72-A-0096)
(AD-A161990) Avail: NTIS HC A06/MF A01 CSCL 09/2

Some of the capabilities of a popular microcomputer (IBM PC) coupled with a popular software package (LOTUS 1-2-3) are reviewed, as these can be easily tailored to various aspects of the construction industry. It can be used as a tool by the owner or project manager and the builder or contractor. While each of these two major participants would be interested in some similar aspects of construction administration, their perspective and required data would necessarily be different. The report presents some uses for identifying, tracking and thereby controlling various aspects of the construction process. Examples are given using the spreadsheet and database capabilities of the LOTUS 1-2-3 program for managing project change orders, construction submittals and inventory control. Also included is a simple example of the graphics capability of LOTUS to illustrate the effectiveness of a pictorial representation of reported numbers. GRA

N86-24240# Naval Postgraduate School, Monterey, Calif.
AN IMPLEMENTATION OF THE PROJECTIVE ALGORITHM FOR LINEAR PROGRAMMING M.S. Thesis
Guenter W. Bretschneider Sep. 1985 44 p
(AD-A162048) Avail: NTIS HC A03/MF A01 CSCL 12/1

An algorithm to solve linear programming problems is presented in this thesis which is based on Karmarkar's projective method. The algorithm includes a practical method to project a general linear programming problem onto a unit simplex and eliminates the a priori need to know the optimal value of the objective function. The implementation conserves sparsity. The key part of the implementation is the solution of a linear least-squares problem to find an improving direction: a direct and an iterative method are implemented to solve this problem. The direct method employs the minimum-degree heuristic to reorder the system of normal equations, and thus conserve sparsity during the following Cholesky factor of the normal equation matrix as a preconditioner for conjugate gradient iterations which are performed implicity on the preconditioned matrix. The study concludes with implementation remarks, and computational results. GRA

N86-24241# Naval Postgraduate School, Monterey, Calif.
FUNCTION PLOTTING SOFTWARE FOR THE IBM-PC AND IBM-7371/7372 PLOTTERS
Alvin F. Andrus Nov. 1985 24 p
(AD-A162066; NPS55-85-029) Avail: NTIS HC A02/MF A01 CSCL 09/2

This report contains a program and user instructions for plotting functions and line graphs on the IBM-7371 or 7372 color plotter. Program input and operation are illustrated and explained. Examples that illustrate program capabilities are included. The program is written in IBM BASICA. The program eliminates the requirement for discrete coordinate inputs in order to plot functions. Continuous single valued functions are defined using the construction rules for standard BASIC expressions. These function definitions then become the program inputs. The program will also accept (X,Y) points and plot a line graph connecting the points. GRA

N86-24242# Hughes Aircraft Co., Fullerton, Calif. Ground Systems Group.
AISIM (AUTOMATED INTERACTIVE SIMULATION MODEL) INSTALLATION AND ACCEPTANCE TEST PLANS AND PROCEDURES Final Report
S. Kneeburg Feb. 1985 220 p
(Contract F33615-81-C-5098)
(AD-A162082; ESD-TR-85-128) Avail: NTIS HC A10/MF A01

CSCL 09/2

This document describes the procedures for installing the automated interactive simulation modeling system (AISIM) on a Vax 11/780 computer and for conducting acceptance testing of the system. This document also contains a description of the contents of the AISIM delivery tapes and the tapes and the steps for building the AISIM system. The description of the AISIM delivery tapes includes a list of all of the files on the tapes and a brief description of each file. The instructions for building AISIM include steps on dumping the tape files to disk and changing all necessary execution command files so that AISIM will execute on a new host. GRA

N86-24243# Duke Univ., Durham, N. C. Dept. of Computer Science.

FINDING TEST-AND-TREATMENT PROCEDURES USING PARALLEL COMPUTATION

L. D. Duval, R. A. Wagner, Y. Han, and D. W. Loveland Oct. 1985 27 p

(Grant AF-AFOSR-0205-83)

(AD-A162141; CS-1985-23; AFOSR-85-1049TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

A parallel algorithm for the NP-hard problem test-and-treatment is presented for a machine whose number of connections is 3p 2 sq, where p is the number of processing elements (PEs), and where the PEs are simple enough such that a machine with 2 to the 20th power PEs is currently implementable and to the 30th power PE machine is feasible. The speedup of O sub p log p is realizable because we are able to transform the dynamic programming solution into the ASCEND/DESCEND scheme with considerable attention to the communication problem. This algorithm is realized on the Boolean Vector Machine, a fully designed cube-connected-cycle system where processor allocation and other control issues have been faced. The particular NP-hard problem is of independent interest; it generalizes the binary testing problem by introducing treatments on an equal basis with tests. Applications of this test-and-treatment problem are found in medical diagnosis, systematic biology, machine fault location, laboratory analysis and many other fields. Author (GRA)

N86-24244# Massachusetts Univ., Amherst. Dept. of Electrical and Computer Engineering.

A STUDY OF ERROR DETECTION AND CORRECTION CODES Final Scientific Report, 1 Feb. 1982 - 31 Jul. 1985

Jack K. Wolf 23 Sep. 1985 12 p

(Grant AF-AFOSR-0061-82)

(AD-A162196; AFOSR-85-0990TR) Avail: NTIS HC A02/MF A01 CSCL 17/2

This research was concerned with a number of topics related to error control for noisy communications channels. Specific topics included: probability of undetected error for error detection codes, coding for discrete-time continuous-amplitude signalling, tail-biting for convolutional codes, combined modulation and coding using amplitude, phase and frequency modulation, and coding for fault tolerant systems and VLSI. GRA

N86-24245# Massachusetts Inst. of Tech., Cambridge.

NUMERICAL ALGORITHMS & PARALLEL TASKING Annual Report, 12 Oct. 1984 - 15 Sep. 1985

Virginia Kelma 12 Sep. 1985 50 p

(Grant AF-AFOSR-0210-82)

(AD-A162221; AFOSR-85-0988TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

The long term goals of this research activity are derived from concurrent computing with emphasis on numerical algorithms that support a variety of scientific applications. Among the applications of immediate interest are signal processing, high statistical methods such as the bootstrap. The shorter term focus has been the refinement and enhancement of the concurrent computing environment itself and the numerical algorithms that form the foundation for the applications. The computer systems that support this research use hardware manufactured by Intel -- with the 8086 cpu and the 8087 floating point processor at the heart of each node. The nodes are contained in workstations (with up to seven Workers and a Manager in a workstation) that can operate independently or can be linked together during execution. Worker structure and memory are configurable to support experiments conducted in the course of this research. GRA

N86-24246# Duke Univ., Durham, N. C. Dept. of Computer Science.

THE CORRECTION OF ILL-FORMED INPUT USING HISTORY-BASED EXPECTATION WITH APPLICATIONS TO SPEECH UNDERSTANDING

Pamela K. Fink and Alan W. Biermann Oct. 1985 46 p

(Grants NSF MCS-79-04120; AF-AFOSR-0205-83; NSF MCS-81-13491)

(AD-A162222; AFOSR-85-1052TR) Avail: NTIS HC A03/MF A01 CSCL 09/2

A method for error correction if ill formed input is described which acquires dialogue patterns in typical usage and uses these patterns to predict new inputs. Error correction is done by strongly biasing parsing toward expected meanings unless clear evidence from the input shows the current sentence is not expected. A dialogue acquisition and tracking algorithm is presented along with a description of its implementation in a power of the error correction methodology when stereotypic dialogue occurs. Author (GRA)

N86-24247# Stanford Univ., Calif. Dept. of Computer Science.

ACQUIRING, REPRESENTING, AND EVALUATING A COMPETENCE MODEL OF DIAGNOSTIC STRATEGY

William J. Clancey Aug. 1985 93 p

(Contract N00014-85-K-0305)

(AD-A162223; SU-STAN-CS-85-1067; TR-13) Avail: NTIS HC A05/MF A01 CSCL 09/2

NEOMYCIN is a computer program that models one physician's diagnostic reasoning within a limited area of medicine. NEOMYCIN's diagnostic procedure is represented in a well-structured way, separately from the domain knowledge it operates upon. We are testing the hypothesis that such a procedure can be used to simulate both expert problem-solving behavior and a good teacher's explanations of reasoning. The model is acquired by protocol, analysis, using a framework that separates an expert's causal explanations of evidence from his descriptions of knowledge relations and strategies. The model is represented by a procedural network of goals and rules that are stated in terms of the effect the problem solver is trying to have on his evolving model of the world. The model is evaluated for sufficiency by testing it in different settings requiring expertise, such as providing advice and teaching. The model is evaluated for plausibility by arguing that the constraints implicit in the diagnostic procedure are imposed by the task domain and human computational capability. This paper discussed NEOMYCIN's diagnostic procedure in detail, viewing it as a memory aid, as a set of operators, as proceduralized constraints, and as a grammar. GRA

N86-24248# Bedford Research Associates, Mass.

MASK.DOC

J. Stevens Aug. 1985 38 p

(Contract F19628-83-C-0090)

(AD-A162224; AFGL-TR-85-0169; SR-1) Avail: NTIS HC A03/MF A01 CSCL 09/2

MASK.DOC is a description of the MASK Programming System for the designing microwave integrated circuits. It is divided into six major parts: (1) part 1 is an introduction to the MASK program. It describes briefly the function of all the modules and related programs of MASK; (2) part 2 describes how a user goes about creating a MASK layout, converting it to CIF, and translating it to either Cornell or Electromask code. It is also explains how to transfer the code to a magnetic tape and how to verify the tape; (3) this section explains how to add a new MASK structure to the structure. It tells which modules to change and how to go about it; (4) this is a programmer's description of MASK. It explains the function of each subroutine in all modules and related programs; (5) this section informs the user how to compile and link all the modules and related programs so as to ready the programs for

execution; and (6) special structures are described here. This section describes the structures that are limited to translation to either Electromask or Cornell format but not both. Author (GRA)

N86-24249# Naval Postgraduate School, Monterey, Calif.
A PRELIMINARY SOFTWARE DESIGN FOR A PERSONAL COMPUTER-BASED ANTISUBMARINE WARFARE TACTICAL FLIGHT SIMULATOR M.S. Thesis
Harold R. Whalen, III Sep. 1985 75 p
(AD-A162255) Avail: NTIS HC A04/MF A01 CSCL 15/1

This thesis provides a preliminary software design for an Antisubmarine Warfare Tactical Flight Simulator. The simulation uses AN/ASN-123 Tactical Navigation Set (TACNAV) display symbology and selectable graphic functions to track and localize a single fully-evasive submarine. The primary design objectives are flexibility, utility, and understandability. A composite design methodology including levels of abstraction, information hiding, coupling, and cohesion as modularization criteria is used to effect a top-down modular decomposition of the simulation. A hierarchical structure is developed and modular packaging is discussed. Some aspects of physical implementation are also discussed and appropriate recommendations made. Author (GRA)

N86-24250# Pittsburgh Univ., Pa. Dept. of Industrial Engineering.
THE APPLICATION OF GENERALIZED GEOMETRIC PROGRAMMING (CONJUGATE DUALITY) TO THE ANALYSIS AND SOLUTION OF CONVEX PROGRAMS Final Technical Report, 16 Jul. 1983 - 15 Jul. 1985
Thomas R. Jefferson 15 Jul. 1985 10 p
(Grant AF-AFOSR-0234-83)
(AD-A162288; AFOSR-85-1055TR) Avail: NTIS HC A02/MF A01 CSCL 09/2

The research in this grant involves the application of generalized geometric programming (conjugate duality) to a variety of problems. The duality theory constructs a dual program which can provide insight into the problem and assist in solution. Composite geometric programming was developed as an important new class of mathematical programming. Applications studied included machining economics, resource allocation, assignment, nonlinear multicommodity network flow problems, mineral processing, statistical analysis of ordinal categorical data, and estimation. Geometric programming was extended from functions of polynomial form to functions which include exponential, logarithmic and other factors by the development of composite geometric programming. This class retains the power of geometric programming while addressing new problems. Certain machining economics problems and chemical equilibrium problems fall into this new class of mathematical programs. Research on the machining economics problem resulted in the problem being reduced from a nonlinear program to a one-dimensional search. In addition, duality theory provided easy parametric analysis. GRA

N86-24251# Naval Postgraduate School, Monterey, Calif.
ANALYSIS OF TWO ADVANCED SMOOTHING ALGORITHMS M.S. Thesis
Jose A. Vasquez, Jr. Sep. 1985 166 p
(AD-A162305) Avail: NTIS HC A08/MF A01 CSCL 12/1

This thesis examines two smoothing algorithms which deviate from the classical method of using only one neighborhood size in the smoothing procedure. The Supersmooth algorithm uses three neighborhood sizes with local cross-validation in order to estimate an optimal neighborhood size. The Split Linear Fit algorithm uses any number of neighborhood sizes and computes a family of linear fits corresponding to each neighborhood size; the final smooth points are a weighted average of the linear fits. These two advanced smoothers are evaluated against the results produced by previously validated, commonly used smoothers and regression techniques. The measure of performance is the quality of the smooth curves and the value of the sum of squared residuals. Author (GRA)

N86-24252# Naval Underwater Systems Center, New London, Conn.
EXTRACTING SIGNAL INFORMATION FROM CONTAMINATED DATA WITH A TWO-DIMENSIONAL ARRAY
Roger F. Dwyer 5 Apr. 1985 45 p
(AD-A162316; NUSC-TM-851054) Avail: NTIS HC A03/MF A01 CSCL 09/4

The use of sensors configured into various geometrical shapes called arrays are important in extracting signal information in many applications. This paper explores the effectiveness of a two-dimensional or planar array in extracting signal information from digitized data when additive Gaussian noise and additive impulsive interference are present. Based on the likelihood ratio approach the data output of each sensor is first passed through a zero-memory device. The zero-memory device is neither a nonlinearity or linearity depending on whether the interference is present or not present, respectively. Further processing utilizes a receiver which converts the data at the output of each zero-memory device into frequency components using a discrete-Fourier transform. The frequency components are then weighted and summed over all spatial sensors. The weights are chosen by maximizing a defined performance measure. It is shown that this optimization procedure does not take into account the debilitating effects of impulsive interference. In order to treat theoretically the inclusion of a nonlinearity, to combat impulsive interference, the concept of an ideal nonlinearity is introduced. GRA

N86-24253# Stanford Univ., Calif. Dept. of Computer Science.
HEURISTIC CLASSIFICATION Technical Report, Jun. 1985
William J. Clancey Aug. 1985 82 p
(Contract N00014-85-K-0305)
(AD-A162344; SU-STAN-CS-85-1066; TR-12) Avail: NTIS HC A05/MF A01 CSCL 09/2

A broad range of well-structured problems--embracing forms of diagnosis, catalog selection, and skeletal planning--are solved in expert systems by the method of heuristic classification. These programs have a characteristic inference structure that systematically relates data to a pre-enumerated set of solutions by abstraction, heuristic association, and refinement. In contrast with previous descriptions of classification reasoning, particularly in psychology, this analysis emphasizes the role of a heuristic in routing problem solving as a non-hierarchical, direct association between concepts. In contrast with other descriptions of expert systems, this analysis specifies the knowledge needed to solve a problem, independent of its representation in a particular computer language. The heuristic classification problem-solving model provides a useful framework for characterizing kinds of problems, for designing representation tools, and for understanding non-classification (constructive) problem-solving methods. Author (GRA)

N86-24254# RAND Corp., Santa Monica, Calif.
ROSIE (TRADEMARK): A PROGRAMMING ENVIRONMENT FOR EXPERT SYSTEMS Interim Report
Henry A. Sowizral and James R. Kipps Oct. 1985 54 p
(Contract MDA903-82-C-0061)
(AD-A162356; RAND/R-3246-ARPA) Avail: NTIS HC A04/MF A01 CSCL 09/2

ROSIE(Rule-Oriented Systems for Implementing Expertise) is an English-like programming language that has evolved over the years into a highly readable, expressive, and powerful tool for building expert systems. Because the language mirrors English, it also serves as a medium of interaction between the knowledge engineer (the computer expert who creates the expert system) and the domain expert (the person whose expertise the system reflects.) This report describes the ROSIE language, emphasizing recent changes and additions, which include meta-elements, shared databases, and demons. Meta-elements capture specific linguistic structures; shared databases provide a facility for coordinating interactions among multiple experts without introducing significant changes to the language; and demons are programs that awaken on specific conditions. The report describes the new facilities, discusses ROSIE's advantages and disadvantages, and considers future directions. Author (GRA)

N86-24255# Arinc Research Corp., Washington, D.C.
SOFTWARE SIZING AND COST ESTIMATION STUDY
Stephen Gross, Kenneth B. Tom, and Everett E. Ayers Sep. 1985 5 p Presented at the 19th Annual Department of Defense Cost Analysis Symposium, Leesburg, Va., 17-20 Sep. 1985
(AD-A162386) Avail: NTIS HC A02/MF A01 CSCL 09/2

This study investigated techniques that would assist Navy programs in more accurately estimating software size in new weapon system developments. The study was exploratory in nature, and presents a description of existing software sizing and estimation methods and an evaluation of their strengths and weaknesses, in addition to a description and tabulation of a sizing data base collected and the estimating relationships developed. GRA

N86-24256# Northwestern Univ., Evanston, Ill. Dept. of Mechanical and Nuclear Engineering.
COMPUTER-AIDED ENGINEERING
H. H. Fong, F. M. Skalak, W. K. Liu, J. Y. Leung, and K. H. Hsu 26 Jun. 1985 6 p Presented at Pressure Vessels and Piping Conference and Exhibition, New Orleans, La 23-26 Jun. 1985
(AD-A162811; AFOSR-85-1108TR) Avail: NTIS HC A02/MF A01 CSCL 09/2

The procedures for analog Monte Carlo simulation of Markov processes are examined. Two variance reduction techniques are then included in a nonanalog formulation to increase the sampling efficiency for highly reliable systems, and a method for incorporating uncertainty in failure and repair rate data is outlined. Models for three classes of component dependencies appearing in reliability and availability problems are incorporated into the Markov formulation. They are: (1) shared repair crews between components, (2) load sharing between components, and (3) standby mode. Results are given for a series of model problems to demonstrate the efficiency of the methods as well as the effects of the dependencies on system unreliability and unavailability. GRA

N86-24257# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
COMMUNICATION AND MISCOMMUNICATION
Bradley A. Goodman Oct. 1985 234 p
(Contracts N00014-77-C-0378; N00014-85-C-0079)
(AD-A162843; BBN-5681) Avail: NTIS HC A11/MF A01 CSCL 09/2

This report discusses one aspect of enabling people to communicate in natural language with computers. The central focus of this work is a study on how one could build robust natural language processing systems that can detect and recover from miscommunication. The study of miscommunication is a necessary task within such a context since any computer capable of communicating with humans in natural language must be tolerant of the complex, imprecise, or ill-devised utterances that people often use. This goal first required an inquiry into how people communicate and how they recover from problems in communication. This led to the development of techniques for avoiding failures of reference that were employed in the reference identification component of a natural language understanding program. The traditional approaches to reference identification in previous natural language systems were found to be less elaborate than people's real behavior. To model a listener's behavior, a new component was added to the traditional reference identification mechanism to resolve difficulties in a speaker's description. GRA

N86-24258# Maryland Univ., College Park. Center for Automation Research.
UPDATING PROPERTIES OF DIRECTED ACYCLIC GRAPHS ON A PARALLEL RANDOM ACCESS MACHINE
Shaunak Pawagi and I. V. Ramakrishnan Sep. 1985 24 p
(Contracts F49620-83-C-0082; N00014-84-K-0530; Grant NSF ECS-84-04399)
(AD-A162954; CAR-TR-148; CS-TR-1551; AFOSR-85-1124TR) Avail: NTIS HC A02/MF A01 CSCL 09/2

Fast parallel algorithms are presented for updating the transitive closure, the dominator tree, and a topological ordering of a directed acyclic graph (DAG) when an incremental change has been made to it. The kinds of changes that are considered here include insertion of a vertex or insertion and deletion of an edge. The machine model used is a parallel random access machine which allows simultaneous reads but prohibits simultaneous writes into the same memory location. The algorithms described in this paper require O(log n) time and use (O cu n) processors. These algorithms are efficient when compared to previously known O(log sq n) time algorithms for initial computation of the above mentioned properties of DAGs. A new algorithm for initial computation of the dominator tree of a DAGis described. The algorithm improves the processor complexity of a previously known algorithm by a factor of n, but does not affect the time complexity, which remains O(log sq n). Author (GRA)

N86-24259# Sandia National Labs., Livermore, Calif.
TOPAZ: THE TRANSIENT ONE-DIMENSIONAL PIPE FLOW ANALYZER. CODE VALIDATION AND SAMPLE PROBLEMS
W. S. Winters Oct. 1985 102 p
(Contract DE-AC04-76DP-00789)
(DE86-002143; SAND-85-8236) Avail: NTIS HC A06/MF A01

TOPAZ is a user friendly computer code for modeling the one-dimensional-transient physics of multi-species gas transfer in arbitrary arrangements of pipes, valves, vessels, and flow branches. This document presents a series of sample problems designed to aid potential users in creating TOPAZ input files. To the extent possible, sample problems were selected for which analytical solutions currently exist. TOPAZ comparisons with such solutions are intended to provide a measure of code validation. DOE

N86-24260# Illinois Univ., Urbana. Dept. of Computer Science.
COMPUTATIONAL METHODS AND SOFTWARE FOR DIFFERENTIAL EQUATIONS AND THEIR APPLICATIONS Annual Report, 16 Nov. 1984 - 15 Nov. 1985
C. W. Gear 1985 12 p
(Contract DE-AC02-76ER-02383)
(DE86-002145; DOE/ER-02383/0110) Avail: NTIS HC A02/MF A01

This report summarizes the progress on the project over the last twelve months. Work has continued in two areas: numerical techniques for differential equations and software tools for scientific problem solving. Within these areas we have been working on the following: (1) Syntax-directed editors for mathematical software, (2) Polylith: a system for module interconnection, (3) mathematical expression input and editing, (4) a tool for examining fill-in in Gauss elimination, (5) a theoretical examination of fill-in, (6) a technique for determining the structural index of a differential-algebraic system, (7) invariant-conserving methods for differential equations, (9) iterative methods for stiff equations, (10) singular two-point boundary value problems, (11) initial value problems in Banach spaces, (12) computational error estimates for stiff ODEs, (13); multigrid solution of collocation equations, and (14) parallel techniques for ordinary differential equations. DOE

N86-24261# Rensselaer Polytechnic Inst., Troy, N.Y.
SOFTWARE SUMMARIES FOR COMPUTER-AIDED CONTROL SYSTEM DESIGN
D. K. Frederick, comp., C. J. Herget, comp., and F. McFarland, comp. Jun. 1985 29 p Prepared in cooperation with Lawrence Livermore National Lab., Calif.
(Contract W-7405-eng-48)
(DE86-002294; UCID-20556) Avail: NTIS HC A03/MF A01

This is a listing of brief summaries of computer-aided control system design software packages, as compiled by Professor Dean K. Frederick of Rensselaer Polytechnic Institute and Dr. Charles J. Herget and Fran McFarland of Lawrence Livermore National Laboratory. DOE

N86-24262# Los Alamos National Lab., N. Mex.
SOPHISTICATED GAMMA-RAY DATA ACQUISITION SYSTEM BASED ON AN IBM PC/XT COMPUTER
C. E. Moss 1985 6 p refs Presented at the IEEE Nuclear Science Symposium, San Francisco, Calif., 23 Oct. 1985
(Contract W-7405-eng-36)

(DE86-002439; LA-UR-85-3755; CONF-851009-9) Avail: NTIS HC A02/MF A01

It is easy to assemble and program an automated gamma-ray data acquisition system consisting of an IBM PC/XT computer and several computer-controllable modules. Our system features pattern recognition to determine the energy calibration, automatic gain setting, automatic efficiency calibration, detector-positioner control, and source-changer control in addition to the more conventional operations. DOE

N86-24263# Oak Ridge National Lab., Tenn.

GRESS: GRADIENT-ENHANCED SOFTWARE SYSTEM. VERSION D, USER'S GUIDE

E. M. Oblow Jul. 1985 72 p

(Contract DE-AC05-84OR-21400)

(DE86-002906; ORNL/TM-9658) Avail: NTIS HC A04/MF A01

GRESS is a FORTRAN pre-compiler that enhances conventional FORTRAN programs with analytic differentiation of arithmetic statements. GRESS handles any standard FORTRAN code which contains arithmetic text material as part of the source program. The GRESS pre-compiler reads the FORTRAN source code text, redefines the variables and their storage locations, searches for arithmetic statements, translates the latter for gradient calculations, and then generates a new source program which now includes gradient capabilities in all arithmetic statements. GRESS therefore, allows any standard FORTRAN code to be upgraded to calculate any derivatives required, whether they be for internal use in a calculation (e.g., for iteration) or for external use (e.g., sensitivity studies). The independent variables with respect to which the partial derivatives are calculated in the FORTRAN source code may be freely selected, and the only theoretical restriction is that the sequence of computations must be continuous and differentiable. The gradients are calculated according to the chain rule of differential calculus and are propagated from operation to operation by the standard chain rule. Thus, no numerical difference scheme is involved and the results are as accurate as any arithmetic computations on the host computer. In this process, the analytic formulas representing the derivatives are neither generated explicitly nor saved. At any stage in the program execution, therefore, the only additional information available in the original code is the numerical value of the gradients. DOE

N86-24264# Los Alamos National Lab., N. Mex.

TOPS: A MULTIGROUP OPACITY CODE

J. Abdallah, Jr. and R. E. H. Clark Oct. 1985 14 p refs

(Contract W-7405-eng-36)

(DE86-003279; LA-10454) Avail: NTIS HC A02/MF A01

From T-4 Opacity Library Data, the TOPS code calculates multigroup opacities that can be written in a variety of formats for use in radiation transport codes. Arbritary mixture of any elements for which OPLIB data exist is supported. Versions of the code exist for both the CRAY-1 and the CRAY X-MP. DOE

N86-24265# Sandia National Labs., Albuquerque, N. Mex.

LINEAR VISCOELASTIC MATERIAL MODE FOR SANCHO

L. S. Costin and C. M. Stone Oct. 1985 52 p

(Contract DE-AC04-76DP-00789)

(DE86-003190; SAND-85-1836) Avail: NTIS HC A04/MF A01

A linear viscoelastic material model has been written for the finite element computer code SANCHO. This material subroutine is capable of modeling linear materials which exhibit both bulk and shear relaxation. In addition, temperature-dependent material response is included in the model in a manner consistant with the theory of thermorheologically simple materials. Both fluid-like and solid-like behavior can be modeled. The formulation used in the subroutine can be applied to problems where both large strains and finite rotations occur. The results of several sample calculations are presented and compared with analytical solutions. DOE

N86-24266# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho.

PROGRAMMING STANDARD

F. S. Miyasaki Jun. 1985 61 p

(Contract DE-AC07-76ID-01570)

(DE86-003210; EGG-RST-6999) Avail: NTIS HC A04/MF A01

Standards are established for the design and coding of scientific computer programs by the Scientific Programming and Advanced Graphics of the Reactor Systems Technology Division of EG and G Idaho, Inc. Subjects covered include background, program design, style, traceability, defensive programming, portability, efficiency, program maintenance and program performance evaluation. DOE

N86-24267# Business and Technological Systems, Inc., Seabrook, Md.

MkD-DELIGHT Final Report

Aug. 1985 231 p

(Contract W-7405-eng-48)

(DE86-003364; UCRL-15729) Avail: NTIS HC A11/MF A01

This report is presented as documentation of the MkD MARV Accuracy Analysis Program, as installed in the DELIGHT system on the ICDC VAX 11/780 computer at LLNL. The INTRODUCTION is intended to provide a background and general description of the generic MkD model and program. The ANALYSIS MANUAL fleshes out the details and description of the model. Finally, the DELIGHT INTERFACE describes the relationship between the MkD model and the DELIGHT system and is essentially a user's manual. The program is intended to provide the user with the capacity to calculate MkD RV contributions to impact errors, and to propagate externally-supplied booster covariance matrices through the MkD trajectory to impact. In addition, these two groups of errors are combined statistically in the program to give their total contribution to the overall system error. DOE

N86-24268# Sandia National Labs., Albuquerque, N. Mex.

SANDIA TASK8: A SUBROUTINED ELECTRON MICROPROBE AUTOMATION SYSTEM

W. F. Chambers Nov. 1985 124 p

(Contract DE-AC04-76DP-00789)

(DE86-003791; SAND-85-2037) Avail: NTIS HC A06/MF A01

The TASK8 is a Flextran program designed to provide instrument control, data acquisition, and data reduction for electron microprobes and scanning electron microscopes equipped with up to seven wavelength-dispersive spectrometers and up to four stage motions (X, Y, Z, and rotation). Instrument control and data acquisition are achieved through a group of mnemonic commands which can be combined into storable subroutines to provide automatic control. The TASK8 also acts as a host program for specialized auxiliary routines which are automatically called as a particular command needs them. Through the use of this technique, it is possible to perform an entire quantitative analysis by issuing the command QUANT and answering the few questions which follow. The SANDIA TASK8 is a systems approach to microprobe automation. Since the majority of the code is in subroutines which are stored in virtual memory, its expansion capabilities are limited by the user's imagination rather than the memory of the machine. The program set currently encompasses TASK8, the master program with its subroutines for machine control and data collection and analysis; CONFIG8, a program for defining instrument operating conditions; and various quantitative analysis programs with their subroutines. Bence-Albee, ZAF, and phi(rhoZ) quantitative techniques are supported. Up to 50 oxides may be analyzed by Bence-Albee or 30 elements by the other techniques. Of special interest to geologists are the abilities to automatically perform end-member calculations and to perform a quantitative analysis by specifying its mineral code. The SANDIA TASK8 software system is used on Cameca MBX microprobes with 2, 3, and 4 spectrometers, on 3, 4, and 5-spectrometer JEOL-733's and on a 5-spectrometer ARL-SEMQ. DOE

N86-24269# Stanford Linear Accelerator Center, Calif.

IMPLEMENTATION AND OPERATING EXPERIENCE WITH A CENTRALIZED MULTI-DISCIPLINARY CAD CAM SYSTEM

R. S. Larsen and J. P. Steffani Sep. 1985 7 p Presented at the 4th DOE Workshop on Computer Aided Engineering, Upton, N.Y.,

10 Oct. 1985
(Contract DE-AC03-76SF-00515)
(DE86-003860; SU-SLAC-PUB-3793; CONF-851060-1) Avail: NTIS HC A02/MF A01

The Stanford Linear Accelerator Center (SLAC) has installed a centralized CAD CAM System to support Electronics, Mechanical, Mechanical Fabrication and Architectural Engineering and Design. The various phases of implementing this system are described, including problems of selection, system software support, maintenance, training, performance evaluation, and future expansion. Some emphasis will be given to the experience with the Electronics disciplines. DOE

N86-24270# Pacific Northwest Lab., Richland, Wash.
EVALUATION OF GRAPHICAL TECHNIQUES FOR DATA IN DIMENSIONS 3 TO 5: SCATTER PLOT MATRIX, GLYPH AND STEREO EXAMPLES
D. B. Carr and W. L. Nicholson 1985 8 p Presented at the American Statistical Association for Joint Statistical Meetings, Las Vegas, Nev., 5 Aug. 1985
(Contract DE-AC06-76RL-01830)
(DE86-004021; PNL-SA-13252; CONF-8508115-7) Avail: NTIS HC A02/MF A01

Numerous methods are available for displaying data in dimensions three through five. While results concerning elementary perceptual tasks are applicable, they do not necessarily indicate the strengths and weaknesses of the display methods for higher-order tasks such as looking for functional form, density patterns (including symmetry and independence), outliners, and local dimensionality. This paper suggests that guidance concerning preferred display techniques can be developed. The approach suggested is the subjective evaluation of graphical techniques as applied to constructed data sets. Constructed data sets serve as informative reference examples, or counter examples, for evaluating the effectiveness of particular techniques. For illustration, several display techniques are applied to a mystery data set with the expressed goal of looking for functional form. Some techniques do not perform well for this example. DOE

N86-24271# Argonne National Lab., Ill.
IMPLEMENTING DENSE LINEAR ALGEBRA ALGORITHMS USING MULTITASKING ON THE CRAY X-MP-4 (OR APPROACHING THE GIGAFLOP)
J. J. Dongarra and T. Hewitt Aug. 1985 6 p
(Contract W-31-109-eng-38)
(DE86-004093; ANL/MCS-TM-55) Avail: NTIS HC A02/MF A01

This note describes some experiments on simple, dense linear algebra algorithms. These experiments show that the CRAY X-MP is capable of small-grain multitasking arising from standard implementations of LU and Cholesky decomposition. The implementation described here provides the fastest execution rate for LU decomposition, 718 MFLOPS for a matrix of order 1000. DOE

N86-24272# MATRA Espace, Toulouse (France). Systems Analysis and Siumlations Group.
A CAD TOOL FOR LEO SPACECRAFT POWER SUBSYSTEM DESIGN (EBLOS UPGRADING) Final Report
B. Fieux Paris ESA Aug. 1985 134 p refs
(Contract ESA-5457/83-NL-PP(SC))
(MATRA-CMT-RS/101/RT/05.85; ESA-CR(P)-2131) Avail: NTIS HC A07/MF A01

The EBLOS software is upgraded to include an improved description and computation of the power profiles, taking into account eclipse conditions, relay visibility, geographical coverage, logical operation modes, and grouping of equipment units. The program also provides a visualization of the results on an Earthmap, a library of models, and postprocessing of the results of the simulation. A graphical description of the system architecture is given and a complete test case is presented. The size of the CAD tool is 42,000 lines of Fortran code. Author (ESA)

N86-24273# Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (West Germany).
GRAPHICAL AND NUMERICAL OPERATING METHOD (GNOM): PROCEDURE LIBRARY [GNOM: DIE GRAPHISCHE UND NUMERISCHE OPERATIONSMETHODE: PROZEDUR-BIBLIOTHEK]
31 Aug. 1985 202 p In GERMAN
(GSI-85-6; ISSN-0171-4546) Avail: NTIS HC A10/MF A01

The status of the GNOM subroutine library is presented. Graphical and preliminary defined objects procedures are explained. Editing and input-output procedures are given. General commands and special commands for programmers are outlined. Author (ESA)

N86-24274# National Bureau of Standards, Gaithersburg, Md. Center for Programming Science and Technology.
SOFTWARE MAINTENANCE MANAGEMENT Final Report
J. A. McCall, M. A. Herdon, and W. M. Osborne Oct. 1985 71 p Prepared in cooperation with Science Applications, Inc., La Jolla, Calif.
(PB86-126745; NBS/SP-500/129; LC-85-600596) Avail: NTIS HC A04MF A01; also available SOD HC $2.75 as 003-003-02681-6 CSCL 09B

The report presents an overview of the various aspects of software maintenance, and provides an indepth analysis of the associated problems, giving particular attention to the most pressing ones. It identifies tools, techniques, and procedures which aid in reducing these problems. This report also provides detailed guidance for managing software maintenance as a separate organizational entity. It also provides assistance needed to develop and employ improved maintenance practices and procedures, that result in reduced software costs and which help to insure that quality software is developed for and by the Federal ADP community. Author (GRA)

N86-24275# National Bureau of Standards, Washington, D.C. Inst. for Computer Sciences and Technology.
CHARACTERISTICS AND FUNCTIONS OF SOFTWARE ENGINEERING ENVIRONMENTS Research Report, 1 Oct. 1984 - 19 Sep. 1985
R. C. Houghton and D. R. Wallace Sep. 1985 45 p Prepared in cooperation with Duke Univ., Durham, N.C.
(PB86-129749; NBSIR-85/3250) Avail: NTIS HC A03/MF A01 CSCL 09B

As part of the program to provide information to Federal agencies on software tools for improving quality and productivity in software development and tenance, data was collected on software engineering environments. Software engineering environments surround their users with software tools necessary for systematic development and maintenance of software. The purpose of this report is to characterize software engineering environments by type and by their relationship to the software life cycle and by their capabilities, limitations, primary users, and levels of support. This report provides examples of existing software engineering environments that are available commercially or in research laboratories with the features and characteristics they provide. GRA

N86-24514*# Oklahoma State Univ., Stillwater.
A TECHNIQUE FOR INCORPORATING THE NASA SPACELAB PAYLOAD DEDICATED EXPERIMENT PROCESSOR SOFTWARE INTO THE SIMULATION SYSTEM FOR THE PAYLOAD CREW TRAINING COMPLEX
Dale A. Bremmer *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 13 p refs (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 09B

N86-24525*# Oakwood Coll., Huntsville, Ala. Dept. of Systems Software.
A STUDY OF THE VERY HIGH ORDER NATURAL USER LANGUAGE (WITH AI CAPABILITIES) FOR THE NASA SPACE STATION COMMON MODULE
Esther N. Gill *In* NASA. Marshall Space Flight Center Research

Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 36 p refs (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 09B

N86-24533*# New Mexico State Univ., University Park. Dept. of Mathematical Sciences.
ANALYSIS OF HIGH-ORDER LANGUAGES FOR USE ON SPACE STATION APPLICATION SOFTWARE
Arthur Knoebel *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 20 p refs (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 09B

N86-24536*# Alabama Univ., Birmingham. Dept. of Computer and Information Science.
MACHINE VISION AND THE OMV
Michael A. McAnulty *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 24 p refs (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 09B

62 COMPUTER SYSTEMS

Includes computer networks.

N86-24276*# SoHaR, Inc., Los Angeles, Calif.
FAULT-TOLERANT SOFTWARE FOR THE FIMP Final Report
Herbert Hecht and Myron Hecht Mar. 1984 82 p refs
(Contract NAS1-15336)
(NASA-CR-166070; NAS 1.26:166070) Avail: NTIS HC A05/MF A01 CSCL 09B

The work reported here provides protection against software failures in the task dispatcher of the FTMP, a particularly critical portion of the system software. Faults in other system modules and application programs can be handled by similar techniques but are not covered in this effort. Goals of the work reported here are: (1) to develop provisions in the software design that will detect and mitigate software failures in the dispatcher portion of the FTMP Executive and, (2) to propose the implementation of specific software reliability measures in other parts of the system. Beyond the specific support to the FTMP project, the work reported here represents a considerable advance in the practical application of the recovery block methodology for fault tolerant software design. Author

N86-24277*# Carnegie-Mellon Univ., Pittsburgh, Pa.
FAULT-FREE VALIDATION OF A FAULT-TOLERANT MULTIPROCESSOR: BASELINE EXPERIMENTS AND WORKOAD IMPLEMENTATION
Frank Feather, Daniel Siewiorek, and Zary Segall Apr. 1986 59 p refs
(Grant NAG1-190)
(NASA-CR-178075; NAS 1.26:178075) Avail: NTIS HC A04/MF A01 CSCL 09B

In the future, aircraft employing active control technology must use highly reliable multiprocessors in order to achieve flight safety. Such computers must be experimentally validated before they are deployed. This project outlines a methodology for doing fault-free validation of reliable multiprocessors. The methodology begins with baseline experiments, which test single phenomenon. As experiments progress, tools for performance testing are developed. This report presents the results of interrupt baseline experiments performed on the Fault-Tolerant Multiprocessor (FTMP) at NASA-Langley's AIRLAB. Interrupt-causing excepting conditions were tested, and several were found to have unimplemented interrupt handling software while one had an unimplemented interrupt vector. A synthetic workload model for realtime multiprocessors is then developed as an application level performance analysis tool. Details of the workload implementation and calibration are presented. Both the experimental methodology and the synthetic workload model are general enough to be applicable to reliable multi-processors besides FTMP. Author

N86-24278# Administrative Sciences Corp., Alexandria, Va.
RISK ASSESSMENT PREPROCESSOR (RAPP)
Colin Hammon, Joseph Augusta, and Susan Fitzgerald 1985 14 p Presented at the 19th Annual Dept. of Defense Cost Analysis Symposium, Leesburg, Va., 17-20 Sep. 1985
(AD-A161914) Avail: NTIS HC A02/MF A01 CSCL 09/2

The Navy's Office for Acquisition Research tasked Administrative Sciences Corporation to develop a management oriented procedure to simplify the selection of the most appropriate risk assessment technique(s) so that project managers will use them to improve management of their programs. Under this tasking the different techniques available for risk assessment were examined and it was concluded that network simulation is both cost effective and feasible for use in almost all acquisition programs. As a result of a critical review of the existing procedures and available software packages, it was concluded that front-end help in getting started was necessary - specifically, assistance in network creation and data preparation and input. The risk assessment preprocessor (RAPP) was created to provide this help. The RAPP is a computer-based procedure for simplifying the process of creating networks and preparing the data for use with a network simulator. RAPP is interactive, easy to use software which will help the user create a network of program activities and input distribution parameters. It does not actually do the risk assessment. The RAPP's output is a data file which is input to one of the several currently available network simulators. It is a tool that makes risk assessment using Monte Carlo simulation easier and less expensive because it reduces the need for senior analysts to structure the network and prepare the data file for input to a risk assessment package. The RAPP allows risk assessment to be used more easily as a tool for project management. GRA

N86-24279# Yale Univ., New Haven, Conn. Dept. of Chemistry.
DATA COMMUNICATION IN HYPERCUBES
Youcef Saad and Martin H. Schultz Oct. 1985 18 p
(Contract N00014-82-K-0184)
(AD-A161975; YALEU/DCS/RR-428) Avail: NTIS HC A02/MF A01 CSCL 12/1

Several algorithms are considered for exchanging data among processors in a hypercube network. The data transfer problems considered are those arising from classical numerical algorithms such as Gaussian elimination, conjugate gradient methods, and the N-body problem. We propose some estimates for the timings of the various algorithms which reveal that multiprocessors based on the hypercube topology can be very efficient in performing data exchange operations. GRA

N86-24280# Duke Univ., Durham, N. C. Dept. of Computer Science.
ASSOCIATIVE NETWORKS ON A MASSIVELY PARALLEL COMPUTER M.S. Thesis
Gary Jackoway Oct. 1985 84 p
(Grant AF-AFOSR-0205-83)
(AD-A162234; AFOSR-85-1050TR) Avail: NTIS HC A05/MF A01 CSCL 09/2

A generalization of semantic networks, called an associative network is mapped onto a massively parallel processor which is currently under development. The results show: the time required to process a query is dependent strictly on the pattern of the query, not on the size of the classes being processed; the order of processing a query does not affect the speed; although we do not receive anywhere near an n-fold speedup by using n processors, we still receive significant performance benefits over a single processor; the associative network may be used not just as a semantic network, for example, it also allows some problems involving numerical minimizations to be solved efficiently. The primary result is that a large number of simple processors, each responsible for a small piece of information, can work in unison

to answer queries significantly faster than a single, highly complex processor can. GRA

N86-24281# Naval Postgraduate School, Monterey, Calif.
DESIGN OF USER FRIENDLY PROTOCOL TO EFFECT A TRANSPARENT INTERNETWORK TRANSACTION FACILITY THROUGH SPLICE (STOCK POINT LOGISTICS INTEGRATED COMMUNICATIONS ENVIRONMENT) AND THE DEFENSE DATA NETWORK M.S. Thesis
Stephen M. Carr Sep. 1985 144 p
(AD-A162263) Avail: NTIS HC A07/MF A01 CSCL 17/2

This thesis explores transparent internetwork connectivity requirements for SPLICE (Stock Point Logistics Integrated Communications Environment). SPLICE nodes shall be interconnected via the DDN (Defense Data Network) to form a wide area network supporting distributed processing. Implementation problems, short and long-term requirements for user terminal to server host transparent connectivity, electronic mail, and process to process internetworking connectivity are presented. Distributed processing through implementation of a DDS (Directory/Dictionary System) is explored. MILSTRIP requisition referral by Stock Points through distributed processing is presented. Implementation of Tandem Corporation's EXPAND/X.25 protocols versus DDN TCP/IP and higher level DDN protocols are discussed. Packet switching, the CCITT X.25 and X.75 protocol standards, and an overview of the DDN TCP/IP protocols are offered in the Appendices.
Author (GRA)

N86-24282# Aerospace Corp., El Segundo, Calif. Information Processing Div.
LOCAL AREA NETWORK IMPLEMENTATION PLAN
William E. Naylor, Stephen D. Crocker, and Andrew W. Sills 1 Nov. 1985 43 p
(Contract F04701-85-C-0086)
(AD-A162317; TR-0086(6920-03)-1; SD-TR-85-83) Avail: NTIS HC A03/MF A01 CSCL 17/2

In this document, a plan is described to deploy a local area network linking together several dispersed computing facilities within The Aerospace Corporation in order to promote the sharing of these internal resources and to provide access to the unique resources of the ARPANET. This plan has grown out of two independent efforts to meet particular communication requirements: (1) in support of VLSI research there is a need for the CAD VAX in D8 to communicate with the ISRO VAX in A2 and with the ARPANET; (2) a LABNET, linking together several existing laboratory computers and a new medium sized computer (called the Lab VAX), is required to satisfy the general resource sharing needs within the Laboratory Operations. The proposed local network meets these needs. The authors propose the use of two technologies for the implementation of this network. ProNET(a token passing ring using various media including fiber optic links) has been selected to provide interbuilding communication. This selection was made because of its relatively long range(2.5 km) and because hardware is available to use fiber optic cable as a medium. Ethernet(a contention bus using 50 ohm coaxial cable) has been selected as the intrabuilding network because of its reduced cost and wide vendor support. The introduction of ETHERNETS should be taken into account during the procurement of new computing equipment(minicomputers, personal computers, word processing systems, etc.). New devices which are compatible with or contain interfaces to ETHERNET can benefit from network services while others cannot. GRA

N86-24283# Los Alamos National Lab., N. Mex.
DATA ACQUISITION AND CONTROL USING ETHERNET
E. P. Elkins 1985 13 p refs Presented at the 2d International Workshop on Accelerator Control Systems, Los Alamos, N. Mex., 7 Oct. 1985
(Contract W-7405-eng-36)
(DE86-002396; LA-UR-85-3583; CONF-8510194-4) Avail: NTIS HC A02/MF A01

A distributed computer control system has been developed to monitor and control a linear accelerator. This system consists of two PDP-11s and eight LSI 11/23s linked together with ETHERNET. The higher level systems (control consoles, etc.) use the RSX11M operating system, whereas the data acquisition and control is performed using the RSX11S operating system downline loaded from a central host computer. Locally written ETHERNET drivers are used to reduce the CPU overhead and therefore improve system response. The ETHERNET system permits remote file access by means of operator or program interaction, as well as supporting downline system loading. Control-system functions supported are supervisory control, closed-loop control, data monitoring, and data recording. DOE

N86-24284# Los Alamos National Lab., N. Mex.
32-BIT FASTBUS COMPUTER
J. M. Blossom, J. P. Hong, and R. G. Kellner 1985 4 p Presented at the IEEE Nuclear Science Symposium, San Francisco, Calif., 23 Oct. 1985
(Contract W-7405-eng-36)
(DE86-002437; LA-UR-85-3781; CONF-851009-10) Avail: NTIS HC A02/MF A01

Los Alamos National Laboratory is building a 32-bit FASTBUS computer using the NATIONAL SEMICONDUCTOR 32032 central processing unit (CPU) and containing 16 million bytes of memory. The board can act both as a FASTBUS master and as a FASTBUS slave. It contains a custom direct memory access (DMA) channel which can perform 80 million bytes per second block transfers across the FASTBUS. DOE

N86-24285# Lawrence Livermore National Lab., Calif.
PASSCAL FIELD DATA MANAGEMENT PLAN (PFDMP)
J. Scheimer, G. Pavlis, D. Blankenship, R. Phinney, S. Malone, B. Karsh, C. Johnson, and W. Prothero Aug. 1985 28 p
(Contract W-7405-eng-48)
(DE86-003192; UCID-20575) Avail: NTIS HC A03/MF A01

The PFDMP is the official planning document for PASSCAL in the area of field data management. It is to be revised and updated from time to time to reflect up-to-date status of the effort. This planning document is concerned less with hardware than with the functional requirements for the field computer systems. Given the rapid changes now happening in the technology of microcomputers and peripherals, it may be safety assumed that systems procured at diferent times will involve different vendors and have different capabilities, costs and specifications. A salient goal is to define the software and database environments with enough flexibility to allow these different models of field computers to function well in the overall data management environment.DOE

63 CYBERNETICS

Includes feedback and control theory.
For related information see also *54 Man/System Technology and Life Support.*

N86-24286 Rensselaer Polytechnic Inst., Troy, N.Y.
DIRECT ADAPTIVE CONTROL IN HILBERT SPACE Ph.D. Thesis
John Ting-Yung Wen 1985 184 p
Avail: Univ. Microfilms Order No. DA8528672

Though great advances have been reported in adaptive control for single-input/single-output (SISO) systems and some multi-input/multi-output (MIMO) systems a large amount of a priori structural information of the plant is needed for most of the methods proposed. This is unsatisfying because all physical systems have some unmodelled dynamics and structure and operate in noisy environment. In fact, in many high performance control system design, the distributed nature of the plant must be taken into account. These distributed parameter systems may be modelled by delayed differential equations, partial differential equations or integral equations. They must be analyzed in the appropriate infinite-dimensional state space. A particular approach, model reference adaptive control (MRAC) with command generator tracker

(CGT) concept, adopts a set of assumptions that are not system dimension dependent. In this thesis, the scheme is modified in order to make the transition of this theory from finite dimensions to the infinite-dimensional Hilbert Space mathematically rigorous. Dissert. Abstr.

N86-24287*# Martin Marietta Aerospace, Denver, Colo.
EVALUATION OF AUTOMATED DECISION MAKING METHODOLOGIES AND DEVELOPMENT OF AN INTEGRATED ROBOTIC SYSTEM SIMULATION: STUDY RESULTS
D. C. Haley, B. J. Almand, M. M. Thomas, L. D. Krauze, K. D. Gremban, J. C. Sanborn, J. H. Kelley, T. M. Depkovich, W. J. Wolfe, and T. Nguyen Mar. 1986 39 p refs
(Contract NAS1-16759)
(NASA-CR-178050; NAS 1.26:178050; MCR-85-665) Avail: NTIS HC A03/MF A01 CSCL 09B

The implementation of a generic computer simulation for manipulator systems (ROBSIM) is described. The program is written in FORTRAN, and allows the user to: (1) Interactively define a manipulator system consisting of multiple arms, load objects, targets, and an environment; (2) Request graphic display or replay of manipulator motion; (3) Investigate and simulate various control methods including manual force/torque and active compliance control; and (4) Perform kinematic analysis, requirements analysis, and response simulation of manipulamotion. Previous reports have described the algorithms and procedures for using ROBSIM. These reports are superseded and additional features which were added are described. They are: (1) The ability to define motion profiles and compute loads on a common base to which manipulator arms are attached; (2) Capability to accept data describing manipulator geometry from a Computer Aided Design data base using the Initial Graphics exchange Specification format; (3) A manipulator control algorithm derived from processing the TV image of known reference points on a target; and (4) A vocabulary of simple high level task commands which can be used to define task scenarios. Author

N86-24288# Office of Naval Research, London (England).
SUMMARY OF EUROPEAN FEEDBACK CONTROL RESEARCH
Charles J. Holland 19 Nov. 1985 16 p
(AD-A162107; ONRL-R-7-85) Avail: NTIS HC A02/MF A01 CSCL 14/2

Feedback control will continue to be an important research area in Europe as well as internationally. This is not only because of applications in traditional areas, ranging from (perhaps mundane) boiler and industrial control to missile guidance, but also because of newer applications areas in robotics and distributed systems such as flexible space structures. Increased performance requirements for US Navy weapons and vehicles will require improved, multivariable-control design analysis and synthesis techniques. Robustness techniques accommodating uncertainty based upon infinity and semiinfinite programming methodologies offer hope for meeting these increased performance requirements. Successful implementation of these theoretical ideas will require the development of reliable numerical algorithms and computer-aided design procedures that incorporate these algorithms. Research in these directions is active both in Europe and in the US. Research in control theory relates to the general area of control (and/or systems theory) and covers a wide range of topics. GRA

N86-24289# Brown Univ., Providence, R. I. Center for Dynamical Systems.
ASYMPTOTIC BEHAVIOR OF CONSTRAINED STOCHASTIC APPROXIMATIONS VIA THE THEORY OF LARGE DEVIATIONS Interim Technical Report
Paul Dupuis and Harold J. Kushner Jul. 1985 55 p
(Grant AF-AFOSR-0116-81)
(AD-A162156; LCDS-85-12; AFOSR-85-1053TR) Avail: NTIS HC A04/MF A01 CSCL 12/1

This document describes a projected recursive (or stochastic approximation) algorithm which arises frequently in applications in control and communications theory. There is a sizeable literature concerning its asymptotic properties as epsilon approaching limit of o with epsilon sub n approaching limit of t or epsilon n approaching infinity. GRA

N86-24290# Naval Postgraduate School, Monterey, Calif.
AUTOMATED POLE PLACEMENT ALGORITHM FOR MULTIVARIABLE OPTIMAL CONTROL SYNTHESIS M.S. Thesis
Wah K. Chow Sep. 1985 171 p
(AD-A162269) Avail: NTIS HC A08/MF A01 CSCL 12/1

This thesis addresses the application of numerical optimization technique to the pole-placement problem in multivariable optimal control. An algorithm is developed to select a set of weighting matrix element such that the conventional transient response criteria are satisfied. General properties of the optimal system in terms of stability, robustness and relative weights between state and control variables were explored by applying the method to the design of two multivariable systems. Results indicated that this method provides good insight to the problem for the designer and is therefore a useful tool in multivariable control synthesis. Author (GRA)

N86-24291# Brown Univ., Providence, R. I. Center for Dynamical Systems.
NEARLY OPTIMAL STATE FEEDBACK CONTROLS FOR STOCHASTIC SYSTEMS WITH WIDEBAND NOISE DISTURBANCES Interim Report
Harold J. Kushner and W. Runggaldier Jul. 1985 42 p
(Contracts DAAG29-84-K-0082; N00014-83-K-0542; Grant AF-AFPSR-0116-81)
(AD-A162271; LCDS-85-23; AFOSR-85-1054TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

Much of optimal stochastic control theory is concerned with diffusion models. Such models are often only idealizations (or limits in an appropriate sense) of the actual physical process, which might be driven by a wide bandwidth (not white) process or be a discrete parameter system with correlated driving noises. Optimal or nearly optimal controls, derived for the diffusion models, would not normally be useful or even of much interest, if they were not also nearly optimal for the physical system which the diffusion approximates. It turns out that, under quite broad conditions, the nearly optimal controls for the diffusions do have this desired robustness property and are nearly optimal for the physical (say wide band noise driven) process, even when compared to controls which can depend on all the (past) driving noise. The authors treat the problem over a finite time interval, as well as the average cost per unit time problem. Extensions to discrete parameter systems, and to systems stopped on first exit from a bounded domain are also discussed. Weak convergence methods provide the appropriate analytical tools. GRA

N86-24292# Stanford Univ., Calif. Dept. of Computer Science.
REVIEW OF SOWA'S CONCEPTUAL STRUCTURES
William J. Clancey Aug. 1985 24 p
(Contract N00014-85-K-0305)
(AD-A162312; SU-STAN-CS-85-1065; KSL-MEMO-85-31; TR-11) Avail: NTIS HC A02/MF A01 CSCL 05/8

Conceptual Structures is a bold, provocative synthesis of logic, linguistics, and artificial intelligence research. At the very least Sowa has provided a clean, well-grounded notation for knowledge representation that many researchers will want to emulate and build upon. At its best, Sowa's notation and proofs hint at what a future Principia Mathematica of knowledge and reasoning may look like. No other AI text achieves so much in breadth, style, and mathematical precision. This is a book that everyone in AI and cognitive science should know about, and that experienced researchers will profit from studying in some detail. Author (GRA)

N86-24293# Brown Univ., Providence, R. I. Div. of Engineering.
CONTROL AND IDENTIFICATION OF TIME VARYING SYSTEMS Final Technical Report, 1 Jul. 1982 - 29 Jun. 1985
Allan E. Pearson 22 Oct. 1985 12 p
(Grant AF-AFOSR-0230-82)
(AD-A162336; AFOSR-85-1086TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Research is summarized on a finite dimensional approach to the feedback stabilization of state delayed control systems via the use of a reducing transformation. Research is described in the parameter identification of time lag systems using a variable projection functional to decouple the estimation of the delay parameters from the remaining system parameters. Research is also described in the use of Fourier based modulating functions for identifying linear, bilinear and polynomial input-output differential systems. GRA

N86-24294# Cornell Univ., Ithaca, N.Y.
NONLINEAR DYNAMICS AND CHAOTIC MOTIONS IN FEEDBACK CONTROLLED ELASTIC SYSTEMS Annual Report, 1 Dec. 1983 - 30 Nov. 1984
P. J. Holmes, F. C. Moon, and R. H. Rand Aug. 1985 29 p
(Grant AF-AFOSR-0051-84)
(AD-A162385; AFOSR-85-1087TR) Avail: NTIS
HC A03/MF A01 CSCL 12/1

Local and global bifurcation studies of nonlinear systems subject to linear and nonlinear feedback forces have been completed which have application to robotic devices or controlled elastic structures. Related to these studies has been the application of mathematical knot theory to trace certain bifurcation sequences for two-dimensional maps. This work has led to the conclusion that many other routes to chaos in dynamical systems exist besides period doubling when the map is two-dimensional. The use of computer algebra (MACSYMA) has been developed as a tool to study nonlinear systems. In one application the investigators explored a new control scheme for flexible space structures based on controlling the stiffness matrix. MACSYMA was used along with normal form theory to predict the stability properties of a stiffness controlled systems. Other studies using MACSYMA related to problems in robotic dynamics were also completed or started. Finally, experimental work was completed involving the application of mathematics to chaotic motion of flexible structures. GRA

N86-24295# SRI International Corp., Menlo Park, Calif.
KNOWLEDGE REPRESENTATION AND NATURAL-LANGUAGE SEMANTICS Final Report, 1 Jun. 1982 - 30 May 1985
Robert C. Moore Aug. 1985 349 p
(Contract F49620-82-K-0031)
(AD-A162389; AFOSR-85-1098TR) Avail: NTIS
HC A15/MF A01 CSCL 05/7

This report summarizes three years of research on a project to produce formalisms, suitable for manipulation by computer, for the representation of specific concepts that are important for natural-language semantics, and to give an independent account of the meaning of such representations using the tools of formal logic. Specific topics on which progress was made include: a logic that characterizes systems that represent and reason with information about their own beliefs, a formalism for the representation of information about the interdependence of knowledge and action, a semantical analysis of adverbial modifiers and event sentences, a formal model of belief based on deduction, additional results on the formal semantics of our logic for reasoning about one's own beliefs, a belief logic that makes weaker than usual assumptions about introspection, and a mathematically rigorous theory of plan synthesis. GRA

N86-24296# Yale Univ., New Haven, Conn. Dept. of Electrical Engineering.
A 4(n + 1)-DIMENSIONAL MODEL REFERENCE ADAPTIVE CONTROL FOR THE STABILIZATION OF ANY STRICTLY PROPER MINIMUM PHASE LINEAR SYSTEMS WITH RELATIVE DEGREE NOT EXCEEDING TWO AND DIMENSION NOT EXCEEDING n
A. S. Morse 10 Jun. 1985 8 p
(Grant AF-AFOSR-0242-84)
(AD-A162808; AFOSR-85-0959TR) Avail: NTIS
HC A02/MF A01 CSCL 12/1

In a recent paper it was shown that there are smooth, nonlinear, three-dimensional controllers, not incorporating probing signals, which are capable of adaptively stabilizing any single-input, single-output, minimum phase, relative degree two or less linear system of any dimension. Controllers of this type are based on minimal dynamic compensator synthesis. While such controllers are simple in structure they do not have a model-following capability. In this paper we develop a new algorithm based on observer theory, which can adaptively stabilize and achieve model-following as well. The controller, which is a smooth nonlinear dynamical system of dimension 4(n+1), can adaptively stabilize any physical process with scalar input u and scalar output y, provided the process can be modelled by a strictly-proper, minimum phase, linear system of dimension not exceeding n and relative degree not exceeding two. GRA

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N86-24297*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
CONVERGENCE OF SPECTRAL METHODS FOR HYPERBOLIC INITIAL-BOUNDARY VALUE SYSTEMS Final Report
David Gottlieb (Tel-Aviv Univ., Israel), Liviu Lustman, and Eitan Tadmor (Tel-Aviv Univ., Israel) Jan. 1986 16 p refs Submitted for publication
(Contracts NAS1-17070; NAS1-18107; Grants AF-AFOSR-0303-85; NSF DMS-85-03294; DAAG29-85-K-0190) (NASA-CR-178063; ICASE-86-8; NAS 1.26:178063) Avail: NTIS
HC A02/MF A01 CSCL 12A

A convergence proof for spectral approximations is presented for hyperbolic systems with initial and boundary conditions. The Chebyshev collocation is treated in detail, but the final result is readily applicable to other spectral methods, such as Legendre collocation or tau-methods. Author

N86-24298# SACLANT ASW Research Center, La Spezia (Italy). Spezia (italy).
FAST FOURIER TRANSFORMATION ALGORITHMS: EXPERIMENTS WITH MICROCOMPUTERS
Brian W. Conolly and Ole F. Hastrup 16 Sep. 1985 15 p
(AD-A161915; SACLANTCEN-SM-182) Avail: NTIS
HC A02/MF A01 CSCL 09/2

Experiments intended to exploit the potential of modern microcomputers for harmonic analysis are described. The findings are a contribution to the discussion of how far modern microcomputers can complement, compete with, and, in certain circumstances, substitute for the mainframe. Harmonic analysis is fundamental to signal processing which, in turn, has many applications both in civilian and military contexts. The publication of so-called Fast Fourier Transform algorithms revolutionised digital analysis: results which previously required many hours of computation could be obtained in minutes. Microcomputers can not yet compete with mainframes in terms of speed but they do have the important advantages of portability and lower cost. Experience shows that equipment exists which combines the advantages of speed and an accuracy adequate for contaminated data, with portability, availability, and versatility that are characteristic of the microcomputer. GRA

N86-24299# Yale Univ., New Haven, Conn. Dept. of Chemistry.
DEFLATED LANCZOS PROCEDURES FOR SOLVING NEARLY SINGULAR SYSTEMS
Tony F. Chan and Youcef Saad Oct. 1985 22 p
(Contracts N00014-82-K-0184; DE-AC02-81-ER10996)
(AD-A161971; YALEU/DCS/RR-403) Avail: NTIS
HC A02/MF A01 CSCL 12/1

The solution of the linear sytem Ax = b, where A is nearly singular is considered. The solution x can be uniquely decomposed into two parts: a generally large component in the direction of the approximate null space of A, and a part that is orthogonal to it. In

many applications, it is desirable to compute this deflated decomposition in a stable and efficient manner. An iterative algorithm based on the Lanczos process is proposed for the case where A is symmetric. The method requires access to A only in the form of a matrix-vector product Av and is efficient for large problems. No a priori knowledge of the approximate null space is needed. Author (GRA)

N86-24300# Yale Univ., New Haven, Conn. Dept. of Chemistry.

COMPLEX SHIFT AND INVERT STRATEGIES FOR REAL MATRICES

Beresford N. Parlett and Youcef Saad Oct. 1985 19 p
(Contracts N00014-76-C-0013; DE-AC02-81ER10996)
(AD-A161974; YALEU/DCS/RR-424) Avail: NTIS HC A02/MF A01 CSCL 12/1

When using an iterative method for solving a generalized nonsymmetric eigenvalue problem of the form Fu = lambda Mu, where f and M are real matrices, it is often desirable to work with the shifted and inverted operator B = (K -A-M) to the minus first power M in order to enhance the eigenvalue separation and improve efficiency. Unfortunately, the shift sigma is generally complex and so is the matrix B. The question then is whether it is possible to avoid complex arithmetic while preserving the advantages of bandedness of the pair (F,M). For the classical problem where M = I and F is banded, complex arithmetic can be avoided by using double shifts, i.e., by working with the real matrix BB whose bandwidth is double that of F. This satisfactory solution extends to the case where M is diagonal as well. In the generalized case the answer to the above question is negative, in the sense that complex arithmetic can be avoided only at the expense of losing the advantage of bandedness. One solution is to factor the shifted matrix F - sigma M in complex arithmetic but employ real arithmetic subsequently in the iterative procedure. Author (GRA)

N86-24301# Yale Univ., New Haven, Conn. Dept. of Computer Science.

STABILITY ANALYSIS OF DIFFERENCE SCHEMES FOR VARIABLE COEFFICIENT SCHRODINGER TYPE EQUATIONS

Tony F. Chan and Longjun Shen Sep. 1985 19 p
(Contracts N00014-82-K-0814; DE-AC02-81ER10996)
(AD-A161989; YALEU/DCS/RR-413) Avail: NTIS HC A02/MF A01 CSCL 12/1

The stability of difference schemes for the solution of the initial boundary value problem for equation where u, A, B, c and f are complex valued functions is considered. Using energy methods, the stability of a general two level scheme which includes Euler's method, Crank-Nicolson's method and the backward Euler method is established. If the coefficient A(x,t) is purely imaginary, the explicit Euler's method is unconditionally unstable. For this case, propose a new scheme is proposed with appropriately chosen artificial dissipation, which is proven to be conditionally stable. GRA

N86-24302# Yale Univ., New Haven, Conn. Dept. of Computer Science.

A DOMAIN-DECOMPOSED FAST POISSON SOLVER ON A RECTANGLE

Tony F. Chan and Diana C. Resasco Aug. 1985 15 p
(Contracts N00014-82-K-0184; DE-AC02-81ER10996)
(AD-A162007; YALEU/DCS/RR-409) Avail: NTIS HC A02/MF A01 CSCL 12/1

This document presents a new domain decomposed fast Poisson solver on a rectangle divided into parallel strips or boxes. The method first performs uncoupled fast solves on each subdomain, and then the interface variables are computed exactly by fast Fourier transform, without computing or inverting the capacitance matrix explicitly. Finally, the solution on the interior of the subdomains can be computed by one more fast solve on each subdomain. This method, as opposed to others, does not involve any iteration in the solution of the system for the interface variables. It is especially suited for parallel implementation, since the independent problems in the subdomains can be solved in parallel, and the communication involves the interface variables only. Author (GRA)

N86-24303# Naval Postgraduate School, Monterey, Calif.

ALGORITHMS AND HEURISTICS FOR TIME-WINDOW-CONSTRAINED TRAVELING SALESMAN PROBLEMS M.S. Thesis

Bock J. Chun and Sang H. Lee Sep. 1985 104 p
(AD-A162118) Avail: NTIS HC A06/MF A01 CSCL 12/1

This thesis reports on methods for solving traveling salesman problems with time-window constraints. Two types of windows are considered: hard time windows, which are inviolable, and soft time windows, which are violable at a cost. For both cases, we develop several heuristic procedures, including some that are based on Stewart's effective heuristics for the traveling salesman problem without time-window constraints. In addition, we develop exact algorithms for each case, which are based on the state-space relaxation dynamic programming method of Christofides, Mingozzi, and Toth. Computational experience is reported for all the heuristics and algorithms we develop. GRA

N86-24304# Massachusetts Univ., Amherst. Dept. of Mathematics and Statistics.

A BIRTH AND DEATH PROCESS APPROXIMATION FOR THE SLOTTED ALOHA ALGORITHM Technical Report

W. Rising and W. Rosenkrantz Aug. 1985 16 p
(Grant AF-AFOSR-0167-82)
(AD-A162153; AFOSR-85-1048TR) Avail: NTIS MF A01 CSCL 12/1

Many authors have concerned themselves with the bistable behavior of the finite-user slotted ALOHA protocol under heaving loading. Recently Nelson used a catastrophe-theoretic approach to demonstrate that under a fluctuating load the protocol suffers hysteresis as well as bistability. He uses results from catastrophe theory to give a possible improved control algorithm. Central to Nelson's approach is a diffusion approximation of the queue of backlogged users. This approximation has the advantage of yielding a continuing probability density for the process, thus allowing the use of (stochastic) catastrophe theory. Unfortunately, as will be seen later, the approximation requires difficult numerical integration and yields no closed form solution. It is being proposed here that the process should remain discrete, and that it can be approximated reasonably well as a birth-death process. This allows rapid computation of the approximate stationary distribution. GRA

N86-24305# Pittsburgh Univ., Pa. Center for Multivariate Analysis.

AN INEQUALITY CONCERNING THE DEVIATION BETWEEN THEORETICAL AND EMPIRICAL DISTRIBUTIONS Technical Report

Lin-Cheng Zhao Aug. 1985 17 p
(Contract F49620-85-C-0008)
(AD-A162169; TR-85-30; AFOSR-85-0978TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

In this paper the author established an inequality concerning the uniform deviation between theoretical and empirical distributions. An application in strong convergence of nearest neighbor density estimate is also discussed. Author (GRA)

N86-24306# State Univ. of New York, Stony Brook. Dept. of Applied Mathematics and Statistics.

CONTINUUM STRUCTURE FUNCTIONS Annual Report, 23 Jul. 1984 - 22 Jul. 1985

Laurence A. Baxter 30 Sep. 1985 17 p
(Grant AF-AFOSR-0243-84)
(AD-A162353; AFOSR-85-1095TR; AR-1) Avail: NTIS HC A02/MF A01 CSCL 12/1

A continuum structure function is a nondecreasing mapping from the unit hypercube to the unit interval. The theory of such functions generalizes the traditional theory of binary and multistate structure functions, permitting more realistic and flexible modelling of systems subject to reliability growth, component degradation and partial availability. During the first year of work on this topic,

the PI has developed a theory of modules (i.e., subsystems), calculated various sets of bounds on the distribution of the structure function when the component states are random variables, deduced axiomatic characterizations of two important special cases and derived a definition of the reliability importance of the various components. Author (GRA)

N86-24307# Brown Univ., Providence, R. I. Center for Dynamical Systems.

HETEROCLINIC ORBITS FOR RETARDED FUNCTIONAL DIFFERENTIAL EQUATIONS

Jack K. Hale and X. B. Lin Dec. 1984 51 p

(Contract DAAG29-83-K-0029; Grants AF-AFOSR-0376-84; NSF DMS-82-05355)

(AD-A162374; LCDS-84-39; AFOSR-85-1018TR) Avail: NTIS HC A04/MF A01 CSCL 12/1

The purpose of this paper is to determine conditions for the occurrence of a heteroclinic orbit gamma function sub micron in a neighborhood of this function for micron in a neighborhood of zero. The authors also want to specify these conditions in terms of computable quantities which can be used to determine either the transversality or the order of nontransversality of the heteroclinic orbit. GRA

N86-24308# Iowa State Univ. of Science and Technology, Ames. Dept. of Mathematics.

NUMERICAL SOLUTION OF ILL POSED PROBLEMS IN PARTIAL DIFFERENTIAL EQUATIONS Annual Technical Report, 1 Oct. 1984 - 30 Sep. 1985

Howard A. Levine Nov. 1985 12 p

(Grant AF-AFOSR-0252-84)

(AD-A162378; AFOSR-85-1094TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Research was undertaken on questions concerning the existence, uniqueness, continuous data dependence and numerical computations of solutions of various ill posed problems in partial differential equations. It was shown that a potential well theory is possible for certain hyperbolic problems in which a nonlinear boundary condition is prescribed and not possible in certain cases when the forcing term in the differential equation is singular. Several papers were accepted or submitted during this period. Examples of titles are: Inequalities between Dirichlet and Neumann eigenvalues, and A potential well theory for the heat equation with a nonlinear boundary condition. Author (GRA)

N86-24309# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.

AN ALGEBRAIC APPROACH TO TIME SCALE ANALYSIS AND CONTROL Ph.D. Thesis

Xi-Cheng Lou Oct. 1985 225 p

(Contract DAAG29-84-K-0005; Grant AF-AFOSR-0258-82)

(AD-A162806; LIDS-TH-1505; AFOSR-85-1129TR) Avail: NTIS HC A10/MF A01 CSCL 12/1

An algebraic approach is developed for multiple time scale decomposition of a linear system using the Smith structure of the system matrix viewed as the matrix of functions of a small parameter c. This derivation makes clear that both the necessary and sufficient multiple semi-stability (MSST) condition, which ensures well-defined multiple time scale behavior and the time-scale-decomposed system structure which approximates the original system are closely related to the so-called Schur complements of a certain matrix. Furthermore, this decomposition has been extended to a larger class of systems, satisfying the so-called multiple semi-simple nullstructure (MSSNS) condition. The algebraic approach is also applied to examine the questions of the feedback control of the linear systems. Specifically this document presents results on time scale modifications by state feedback. GRA

N86-24310# South Carolina Univ., Columbia. Dept. of Mathematics and Statistics.

SOME CONVERGENCE RESULTS FOR KERNEL-TYPE QUANTILE ESTIMATORS UNDER CENSORING

Y. L. Lio and W. J. Padgett Nov. 1985 18 p

(Contract MIPR-ARO-139-85; Grant AF-AFOSR-0156-84)

(AD-A162837; TR-108; AFOSR-85-1122TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Based on right-censored data from a lifetime distribution, a kernel-type estimator of a certain quantile function is studied. This estimator is smoother than a product-limit quantile function. This document also covers: asymptotic normality; asymptotic mean equivalence; and mean square convergence. GRA

N86-24311# California Univ., San Diego. Inst. for Cognitive Science.

STRUCTURAL UNDERSTANDING IN PROBLEM SOLVING. SPECIFYING AND INSTRUCTING COGNITIVE OBJECTIVES IN BASIC ELECTRICITY Progress Report,

Mary S. Riley 30 Aug. 1985 10 p

(Contract N00014-84-K-0579)

(AD-A162845; PR-1) Avail: NTIS HC A02/MF A01 CSCL 05/10

A common instructional objective in domains of math and science is the capability to use formulas and arithmetic procedures to solve problems. Although students are explicitly taught the relevant formulas and principles, are shown worked-out examples, and are given practice, they frequently experience considerable difficulty when asked to solve similar problems. Previous research suggested that difficulties often result from mechanical application of rules and formulas with little understanding of important structural relations between the elements in the problem domain. The objective of this research is to analyze in greater detail what is meant by structural understanding within the domain of basic electricity, the role this understanding plays in performance and learning, and the extent to which important structural relations can be taught more directly. Research has involved: (1) empirical studies of the knowledge students acquire (and fail to acquire) both from the Navy's Basic Electricity and Electronics (BE&E) course material and from alternative instructional materials and (2) theoretical analyses in the form of computer simulation models that represent detailed hypotheses about the knowledge underlying student's performance and learning. GRA

N86-24312# North Carolina Univ., Chapel Hill. Dept. of Statistics.

ON A JOINT STRONG APPROXIMATION THEOREM FOR RECORD AND INTER-RECORD TIMES

Dietmar Pfeifer Oct. 1985 15 p

(Contract F49620-85-C-0144)

(AD-A162868; TR-120; AFOSR-85-1180TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

This report presents a simple joint strong approximation for the logarithms of record and inter-record times from an exchangeable sequence, including an exact estimation for the rate of convergence in terms of upper and lower class functions of a Wiener process. The approach chosen here allows for simple proofs of exact and asymptotic (joint) results for record and inter-record times, such as the Law of Large Numbers, Central Limit Theorem and Law of the Interated Logarithm, and others. Author (GRA)

N86-24313# Rensselaer Polytechnic Inst., Troy, N.Y. Dept. of Mathematical Sciences.

NON-LINEAR SYSTEMS IN INFINITE DIMENSIONAL STATE SPACES Final Report, 15 Jun. 1981 - 14 Sep. 1985

M. Slemrod Oct. 1985 9 p

(Grant AF-AFOSR-0172-81)

(AD-A162869; AFOSR-85-1121TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

During the period covered by this grant the principal investigator wrote 17 papers. The titles of which include: Scanning Control of a Vibrating String, Dynamic Phase Transitions in a Van Der Waals Fluid, The Viscosity-capillarity Admissibility for Shocks and Phase Transitions, Lax-Friedrichs and the Viscosity-capilarity Criteria and Temporal and Spatial Chaos in a Van der Waals Fluid due to Periodic Thermal Fluctuations. GRA

N86-24314# Florida State Univ., Tallahassee. Dept. of Statistics.
PEAKEDNESS OF WEIGHTED AVERAGES OF JOINTLY DISTRIBUTED RANDOM VARIABLES
Wai Chan, Dong Ho Park, and Frank Proschan Oct. 1985 10 p
Prepared in cooperation with Nebraska Univ., Lincoln and Ohio State Univ., Columbus
(Contract F49620-82-K-0007)
(AD-A162876; FSU-STATISTICS-M712; TR-85-184; AFOSR-85-1123TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

This note extends the Proschan (1965) result on peakedness comparison for a convex combination of i.i.d. random variables from a PF sub 2 density. Now the underlying random variables are jointly distributed from a Schur-concave density. The result permits a more refined description of convergence in the Law of Large Numbers. Author (GRA)

N86-24315# Washington Univ., Seattle. Dept. of Psychology.
THE DESIGN OF BALLANTINES
Earl Hunt 15 Aug. 1985 26 p
(Contract N00014-84-K-5553)
(AD-A162889; TR-8) Avail: NTIS HC A03/MF A01 CSCL 12/1

The widespread availability of computational graphics for personal computers has greatly increased the potential for visual displays of data. The display of pairwise correlations between two and three variables is of special interest to psychologists. To motivate the subsequent development, consider a case that arose in our own laboratory. College students participated in three tasks, an auditory dichotic listening task, a visual scanning task, and an arithmetic task. Our interest was in the extent to which variance was shared between pairs of tasks, with some portion of the variance in the third task held constant. Part and partial correlations may be used to express the statistical relations. However this method of summarization was not appropriate for verbal presentations of our results, especially to audiences who were not familiar with advanced methods of correlational analysis. An alternative to the statistical summary is to use a visual display, in which the variance of each variable is represented by a circle. Shared variance is represented by the overlap between two circles. If three variables are represented the resulting figure is called a ballantine. The ballantine is a useful display of shared and unique variance because each component of variance can be identified visually in the geometric form. GRA

N86-24316# Yale Univ., New Haven, Conn. Dept. of Computer Science.
ANALYSIS OF PRECONDITIONERS FOR DOMAIN DECOMPOSITION
Tony F. Chan Aug. 1985 13 p
(Contract DE-AC02-81ER10996)
(AD-A162925; YALEU/DCS/RR-408) Avail: NTIS HC A02/MF A01 CSCL 09/2

Domain decomposition is a class of techniques that is designed to solve elliptic problems on irregular domains and on multiprocessor systems. Typically, a domain is decomposed into many smaller regular subdomains and the capacitance system governing the interface unknowns is solved by some version of the preconditioned conjugate gradient method. In this paper, we show that for a simple model problem -Poisson's equation on a rectangle decomposed into two smaller rectangles -- the capacitance system can be inverted exactly by fast Fourier transform. No iteration is needed. An exact eigen-decomposition of the capacitance matrix also makes possible a comparison of various preconditioners that have been proposed in the literature. For example, we show that in the limit as the aspect ratio of the two rectangles tend to infinity, the preconditioner proposed by Golub-Mayers becomes exact, but the one proposed by Dryja does not. Both preconditioners, however, are poor when the aspect ratio is small. Author (GRA)

N86-24317# Stanford Univ., Calif. Center for Large Scale Scientific Computation.
ON DOMAIN DECOMPOSITION
Christopher R. Anderson Oct. 1985 45 p
(Contract N00014-82-K-0335; Grant NSF MCS-83-11685)
(AD-A162933; CLASSIC-85-09) Avail: NTIS HC A03/MF A01 CSCL 12/1

This report discusses aspects of the method of domain decomposition for the solution of elliptic boundary value problems in two dimensions. The basic idea behind the technique is to piece together local solutions of the elliptic problem to form a global solution. There are several reasons for wanting to use such a procedure. The first is that a given domain may be irregular, but can be subdivided into regular pieces for which solutions are computationally efficient to obtain. Another reason is that the method may be suitable for solving elliptic problems on multiple processor machines. If, for example, one breaks up the domain into many small pieces and allocates a processor to each piece, then there is the possibility of decreasing the computational time by constructing the local solutions in parallel and gluing them together. The purpose of this report is to examine model problems with the intention of providing motivation and insight concerning results previously presented as well as offer some new observations that may aid in the implementation of the method. GRA

N86-24318# North Carolina Univ., Chapel Hill. Center for Stochastic Processes.
A MARTINGALE CHARACTERIZATION OF MIXED POISSON PROCESSES Technical Report, 1 Sep. 1985 - 31 Aug. 1986
Dietmar Pfeifer Oct. 1985 11 p
(Contract F49620-85-C-0144)
(AD-A162957; TR-119; AFOSR-85-1177TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

It is shown that an elementary pure birth process is a mixed Poisson process if the sequence of post-jump intensities forms a martingale with respect to the delta-fields generated by the jump times of the process. In this case, the post-jump intensities converge a.s. to the mixing random variable of the process. Author (GRA)

N86-24319# Stanford Univ., Calif. Lab. for Computational Statistics.
NONPARAMETRIC LIKELIHOOD RATIO INTERVALS
Art Owen Nov. 1985 18 p
(Contract N00014-83-K-0472)
(AD-A162978; LCS-TR-6) Avail: NTIS HC A02/MF A01 CSCL 12/1

This article discusses the well-known nonparametric maximum likelihood estimate of a distribution function F sub 0 and explores interval estimation where R is a nonparametric likelihood ratio function for distributions. GRA

N86-24320# Rhode Island Univ., Kingston. Dept. of Electrical Engineering.
SIMPLE, EFFECTIVE COMPUTATION OF PRINCIPAL EIGENVECTORS AND THEIR EIGENVALUES AND APPLICATION TO HIGH-RESOLUTION ESTIMATION OF FREQUENCIES Final Report, Oct. 1984 - Oct. 1985
Donald W. Tufts and Costas D. Melissinos Oct. 1985 36 p
(Contracts N00014-83-K-0664; N00014-84-K-0445; Grant NSF ECS-84-08997)
(AD-A163107) Avail: NTIS HC A03/MF A01 CSCL 12/1

The results of an investigation of the Prony-Lancozos (P-L) method 14,38 and the power method 39 for simple computation of approximations to a few eigenvectors and eigenvalues of a Hermitian matrix are presented. The realization of high-resolution signal processing in an integrated circuit is anticipated. The computational speeds of the above methods are analyzed. They are completely dependent on the speed of a matrix-vector product operation. If only a few eigenvalues or eigenvectors are needed, the suggested methods can substitute for the slower methods of the LINPACK or EISPACK subroutine libraries. The accuracies of the suggested methods are evaluated using matrices formed from simulated data consisting of two sinusoids plus gaussian noise. Comparisons are made with the corresponding eigenvalues and eigenvectors obtained using LINPACK. Also the accuracies of

frequency estimates obtained from the eigenvectors are compared. GRA

N86-24321# Massachusetts Inst. of Tech., Cambridge. Lab. of computer Science.
A GENERALIZED APPROACH TO EQUATIONAL UNIFICATION M.S. Thesis
Katherine A. Yelick Aug. 1985 105 p
(Contract N00014-83-K-0125)
(AD-A163112; MIT/LCS/TR-344) Avail: NTIS HC A06/MF A01 CSCL 12/1

Given a set of equational axioms and two terms containing function symbols and variables, the equational unification problem is to find a uniform replacement of terms for the variables that makes the terms provably equal from the axioms. In the general case, the two terms may contain symbols not appearing in the axioms, there may be more than one instance of a set of axioms, and there may be more than one set of axioms. This thesis presents a method for combining equational algorithms to handle the terms with mixed sets of function symbols. For example, given one algorithm for unifying associative-cummutative operators, and another for unifying commutative operators, the author's algorithm provides a method for unifying terms containing both kinds of operators. It is based on a general strategy for decomposing terms and combining unifiers. Attention is restricted to set of axioms whose function symbols are pairwise disjoint. GRA

N86-24322# Brookhaven National Lab., Upton, N. Y.
PRECONDITIONED ITERATIVE METHODS APPLIED TO SINGULARLY PERTURBED ELLIPTIC BOUNDARY VALUE PROBLEMS
C. I. Goldstein 1985 63 p
(Contract DE-AC02-76CH-00016)
(DE86-003125; BNL-51916) Avail: NTIS HC A04/MF A01

A class of multigrid preconditioners is developed, analyzed, and tested in connection with the iterative solution of multi-dimensional boundary value problems for which the magnitude of the coefficients of the lower order terms are large compared to the coefficients of the highest order terms. In particular, this occurs in connection with singularly perturbed elliptic boundary value problems, where the coefficients are characterized by a parameter, epsilon, that varies over a specified parameter range. Conjugate gradient type iterative methods are applied to the large, sparse system of linear equations arising from a finite element or finite difference discretization. It is proved for variable coefficient partial differential operators that the condition number of the preconditioned matrix is uniformly bounded for all epsilon, provided the number of grid levels in a partial multigrid cycle is suitably chosen as a function of epsilon. The multigrid cycle is applied to the five-point scheme for the Dirichlet problem, even when more complicated differential operators and higher order discretizations are considered. This preconditioner is well suited for implementation on vector and parallel computers. DOE

N86-24323# Argonne National Lab., Ill.
PROJECTED NEWTON METHOD FOR l/SUB p/ NORM LOCATION PROBLEMS
P. H. Calamai and A. R. Conn Aug. 1985 37 p refs
(Contract W-31-109-eng-38)
(DE86-003165; ANL/MCS-TM-56) Avail: NTIS HC A03/MF A01

This paper is concerned with the numerical solution of continuous minisum multifacility location problems involving the l sub p norm, where $1 < p <$ infinity. This class of problems is potentially difficult to solve because the objective function is not everywhere differentiable. After developing conditions that characterize the minimum of the problems under consideration, a second-order algorithm is presented. This algorithm is based on the solution of a finite sequence of linearly constrained subproblems. Descent directions for these subproblems are obtained by projecting the Newton direction onto the corresponding constraint manifold. Univariate minimization is achieved via a specialized linesearch which recognizes the possibility of first derivative discontinuity (and second derivative unboundedness) at points along the search direction. The algorithm, motivated by Calamai and Conn and related to methods recently described by Overton and Dax, is shown to possess both global and quadratic convergence properties. Degeneracy can complicate the numerical solution of the subproblems. This degeneracy is identified, and a method for handling this degeneracy is outlined. An implementation of the algorithm, that exploits the intrinsic structure of the location problem formulation, is then described along with a discussion of numerical results. DOE

N86-24324# Sandia National Labs., Albuquerque, N. Mex.
MONITORING STABILITY WHEN SOLVING ODEs NUMERICALLY
L. F. Shampine Nov. 1985 15 p refs
(Contract DE-AC04-76DP-00789)
(DE86-003796; SAND-85-2297) Avail: NTIS HC A02/MF A01

A simple and inexpensive way to monitor the stability of the common numerical schemes for the solution of the initial value problem for a system of ordinary differential equations (ODEs) is proposed. An important application to the solution of stiff problems by extrapolation of a semi-implicit midpoint rule is made. DOE

N86-24325# Argonne National Lab., Ill.
COMMENTS ON THE SOLUTION OF SPARSE LINEAR EQUATIONS
I. S. Duff Sep. 1985 18 p
(Contract W-31-109-eng-38)
(DE86-003984; ANL/MCS-TM-58) Avail: NTIS HC A02/MF A01

We consider primarily direct methods for the solution of sparse linear equations. We first illustrate the wide range of sparse matrix types that arise in different application areas. It is clear that methods taking advantage of a particular structure should do better than a general technique designed for all classes of sparse matrices. We comment on this both philosophically and empirically. We discuss the techniques used in general solution schemes and those used in particular applications - for example, the solution of equations resulting from discretizations of partial differential equations. We also consider the use of direct methods as a preconditioning to iterative methods for solution. We look at work in combinatorial algorithms that relates to the solution of sparse equations and comment on some of the open problems in this and other areas. Throughout we comment on available software and the relative performance of the methods as implemented in those software packages. DOE

N86-24530*# Alabama Univ., Tuscaloosa. Dept. of Mathematics.
A METHOD FOR LINEARIZING A NONLINEAR SYSTEM WITH SIX STATE VARIABLES AND THREE CONTROL VARIABLES
Wei-Shen Hsia *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 25 p ref (For primary document see N86-24507 14-80) Avail: NTIS HC A99/MF E04 CSCL 12A

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N86-24326# Naval Research Lab., Washington, D. C.
INDEPENDENCE AND BAYESIAN UPDATING METHODS
R. W. Johnson 6 Nov. 1985 8 p
(AD-A161863; NRL-MR-5689) Avail: NTIS HC A02/MF A01 CSCL 12/1

Duda, Hart, and Nilsson have set forth a method for rule-based inference systems to use in updating the probabilities of hypotheses on the basis of multiple items of new evidence. Pednault, Zucker, and Muresan claimed to give conditions under which independence assumptions made by Duda et al, preclude updating - that is, prevent the evidence from altering the probabilities of the hypotheses. Glymour refutes Pednault et al.'s claim with a counterexample of a rather special form (one item of

evidence is incompatible with all but one of the hypotheses); he raises, but leaves open, the question whether their result would be true with an added assumption to rule out such special cases. We show that their result does not hold even with the added assumption, but that it can nevertheless be largely salvaged. Namely, under the conditions assumed by Pednault et al., at most one of the items of evidence can alter the probability of any given hypothesis; thus, although updating is possible, multiple updating for any of the hypotheses is precluded. GRA

N86-24327# Defence Research Establishment Atlantic, Dartmouth (Nova Scotia).
A LEAST SQUARES ALGORITHM FOR FITTING PIECEWISE LINEAR FUNCTIONS ON FIXED DOMAINS
B. A. Trenholm Sep. 1985 41 p In ENGLISH; Abstract in FRENCH
(AD-A161870; DREA-TM-85/215) Avail: NTIS HC A03/MF A01 CSCL 12/1

A least squared error algorithm is presented for fitting a piecewise linear function to observed data, when the slope of the function is allowed to change only at specified points. The algorithm can be used to estimate piecewise linear trends in data, where the locations of possible changes in trend are known. Furthermore, it can be used to reduce large quantities of data to manageable sizes. In addition, the algorithm is robust to problems of data dropout provided it is used cautiously. An example of a possible application is the fitting of a linear segment bathythermal profile (temperature vs depth) to a large quantity of data. Author (GRA)

N86-24328# Cornell Univ., Ithaca, N.Y. School of Operations Research and Industrial Engineering.
ON SELECTING THE BEST OF K SIMULATED SYSTEMS: AN EXPOSITORY SURVEY Final Technical Report, 31 Mar. 1984 - 31 Aug. 1985
David Goldsman and Lee W. Schruben 15 Nov. 1985 32 p
(Contract N00014-81-K-0037)
(AD-A161903; TR-596) Avail: NTIS HC A03/MF A01 CSCL 12/2

This research has focused on simulation analysis using two new techniques, frequency domain experiments and standardized time series. The problem of selecting the best one of k arbitrary systems or alternatives is investigated. Consider one observation from each of the k systems. By best, meant that system which has the highest probability of yielding the most desirable of the k observations. The term most desirable is defined according to some criterion of goodness determined by the experimenter. It is shown that this problem can be formulated as a multinomial selection problem. Hence, multinomial selection procedures are, in a sense, nonparametric procedures. An up-to-date survey of such multinomial procedures is given. Further, how some of these procedures can be adapted for use in the simulation environment is described. GRA

N86-24329# Institute for Defense Analyses, Alexandria, Va.
A TECHNIQUE TO HELP CHOOSE BETWEEN ALTERNATIVE FUNCTIONAL FORMS OF THE REGRESSION EQUATION
Thomas P. Frazier 1985 10 p Presented at the 19th Annual Dept. of Defense Cost Analysis Symposium, Leesburg, Va., 17-20 Sep. 1985
(AD-A161909) Avail: NTIS HC A02/MF A01 CSCL 12/1

The cost analyst is often faced with the problem of choosing among several different functional forms of a regression equation. For example, a problem frequently encountered in empirical cost research is the choice between a linear and a log-linear equation. Ideally, theory tells the researcher which to choose. However, in the absence of any firm theoretical indication, the cost researcher must resort to some ad hoc procedure in choosing between the functional forms. If the appropriate functional form is not used the estimate may be biased and/or inefficient. A procedure often used is to run both functional forms and select the one with the largest coefficient of determination (R-square). Unfortunately, the R-square statistic of equations 1 and 2 cannot be meaningfully compared because the dependent variables in the two equations are different. The specification of the model, the error terms, and the computation of R-square for these two equations are entirely different and provide no common ground for comparison of the relative performance of these equations on the basis of computation of R-square. GRA

N86-24330# Cornell Univ., Ithaca, N.Y. School of Operations Research and Industrial Engineering.
NEW CONFIDENCE INTERVAL ESTIMATORS USING STANDARDIZED TIME SERIES
David Goldsman and Lee W. Schruben Dec. 1984 12 p
(Contract N00014-81-K-0037)
(AD-A161978; TR-J-84-15) Avail: NTIS HC A02/MF A01 CSCL 12/1

We develop new confidence interval estimators for the underlying mean of a stationary simulation process. These estimators can be viewed as generalizations of Schruben's so-called standardized time series area confidence interval estimators. Various properties of the new estimators are given. GRA

N86-24331# Cornell Univ., Ithaca, N.Y.
FREQUENCY DOMAIN EXPERIMENTS: SPECTRAL AMPLIFICATION, INPUT-OUTPUT CORRELATIONS AND MODEL PARAMETERS Interim Report, 31 Mar. 1984 - 25 Aug. 1985
V. J. Cogliano and Lee W. Schruben 25 Aug. 1985 10 p
(Contract N00014-81-K-0037)
(AD-A161979) Avail: NTIS HC A02/MF A01 CSCL 20/14

A frequency domain approach to identifying a polynomial response model for a system was presented in an earlier document. Frequency domain experiments can help identify important input factors (or parameters) and interactions in systems where one can change factor values during an experimental trial and observe the response at periodic intervals. An example of such a system is a simulation run on a computer. The relationships between spectral amplification, input-output correlation, and factor values for such experiments are considered. Conditions are also given for which the frequency domain approach is equivalent to ranking prospective terms in a response model by their correlation with the output. Author (GRA)

N86-24332# George Washington Univ., Washington, D.C. Inst. for Management Science and Engineering.
RESULTS OF A SIMULATION STUDY TO MEASURE THE EFFECTIVENESS OF EMPIRICAL BAYES' ESTIMATES OF MULTIPLE PROBABILITIES
S. S. Brier, Z. Zacks, and W. H. Marlow 10 Jul. 1985 20 p
(Contract N00014-83-K-0216)
(AD-A161982; GWU/IMSE/SERIAL-T-499/85) Avail: NTIS HC A02/MF A01 CSCL 12/1

Empirical Bayes' methods have been used by Brier, Zacks, and Marlow (1985) to estimate a set of parameters where each parameter is a k-dimensional vector consisting of the probabilities that a Marine combat unit will successfully complete requirements in each of k different categories. This paper assesses the performance of the empirical Bayes' estimators by simulating parameters from a multivariate normal distribution and simulating the observed sample counts from the binomial distribution. The empirical Bayes' estimators are compared to the sample proportion in terms of mean square error and absolute deviations. Using both criteria, the Bayes' estimators are shown to provide considerable improvement across a wide range of parameter values. The results suggest that empirical Bayes' estimates are useful in a variety of situations where a set of multivariate binomial probabilities are to be estimates. GRA

N86-24333# State Univ. of New York, Buffalo. Buffalo Dept. of Psychology.
INTER-DOMAIN FIT AND THE PERCEIVED QUALITY OF LIFE Interim Technical Report
Robert W. Rice, Michael R. Frone, and Dean B. McFarlin Oct. 1985 22 p
(Contract N00014-84-K-0002)

(AD-A161993; TR-4-ONR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Survey responses from a 1977 national probability sample of 1515 employed Americans working at least 20 hours per week provided a test of competing predictions concerning the incremental utility of perceived inter-domain fit in predicting overall perceived quality of life (pQL). If additive models are inadequate in the sense of failing to consider inter-domain interactions, measures of perceived inter-domain fit should add substantially to the prediction of overall pQL. On the other hand, if additive models are adequate, measures of inter-domain fit should not add substantially to the prediction of overall pQL. GRA

N86-24334# Pittsburgh Univ., Pa. Center for Multivariate Analysis.

EFFECT OF ADDITIONAL VARIABLES IN PRINCIPAL COMPONENT ANALYSIS, DISCRIMINANT ANALYSIS AND CANONICAL CORRELATION ANALYSIS

Y. Fujikoshi, P. R. Krishnaiah, and J. Schmidhammer Aug. 1985 20 p

(Contracts F49620-85-C-0008; F49620-82-K-0001)

(AD-A162069; TR-85-31; AFOSR-85-0980TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

In this paper, the authors derived asymptotic distributions of changes in certain functions of the eigenvalues of the sample covariance matrix, MANOVA matrix and canonical correlation matrix when some variables are added to the original sets of variables. The above results are useful in finding out as to whether the new variables give additional information for statistical inference, multivariate analysis, and Wishart distribution. Author (GRA)

N86-24335# Alphatech, Inc., Burlington, Mass.

PERFORMANCE ANALYSIS FOR HYBRID STATE ESTIMATION PROBLEMS Final Report

R. B. Washburn, T. G. Allen, and D. Teneketzia Oct. 1985 98 p

(Contract N00014-84-C-0370)

(AD-A162225) Avail: NTIS HC A05/MF A01 CSCL 12/1

Hybrid state estimation problems are statistical estimation problems in which both continuous-valued and discrete-valued states and parameters occur. The hybrid state model provides both a natural formulation for many types of surveillance and tracking problems and a powerful framework for deriving theoretically optimal and practical suboptimal tracking algorithms. This report describes research in developing tools for evaluatng the performance of optimal hybrid state estimation problems. GRA

N86-24336# Naval Underwater Systems Center, New London, Conn.

SPECTRAL ANALYSIS VIA LAG-RESHAPING OF THE CORRELATION ESTIMATE; PROGRAMS AND SIMULATION RESULTS

Albert H. Nuttall 16 Aug. 1985 63 p

(AD-A162229; NUSC-TR-7511) Avail: NTIS HC A04/MF A01 CSCL 09/3

The fundamental performance of the generalized spectral analysis technique employing quadratic frequency-smoothing of Fourier-transformed, overlapped, weighted data segments was thoroughly investigated analytically and reported. The analysis exists to do lag-reshaping of the first-stage correlation estimate, and thereby realize effective spectral window with low sidelobes and good decay rates, without the need for overlap or any temporal weighting. However, no programs or simulation result. This situation is rectified by presenting programs for achieving maximally stable low-sidelobe spectral estimates via the lag-reshaping procedure and then employing these routines to exhibit some simulation results for data with tones and noise. Attention is given to the case of abutting rectangular temporal weightings with no overlap; this procedure is done with appropriate lag-reshaping. GRA

N86-24337# Naval Postgraduate School, Monterey, Calif.

TIME SERIES MODELS WITH A SPECIFIED SYMMETRIC NON-NORMAL MARGINAL DISTRIBUTION M.S. Thesis

Lee S. Dewald, Sr. Sep. 1985 254 p

(AD-A162262) Avail: NTIS HC A12/MF A01 CSCL 12/1

Time series models with autoregressive, moving average and mixed autoregressive-moving averager correlation structure and with symmetric, heavy-tailed, non-normal marginal distributions, called (letter)-Laplace, are considered. First, a flexible mixed model NLARMA(p,q) with Laplace (double exponential) marginals is investigated. Second, a family of continuous random coefficient models with l-Laplace distributions are examined. The Laplace distribution is described along with a useful transformation. Thirdly, the NLAR(1) and the BELAR(1) processes are compared using higher order residual analyses based on the uncorrelated, but dependent linear residuals, (R sub n). Finally, open problems, as well as possible extensions and applications of the analyses given in this thesis are discussed. GRA

N86-24338# Pittsburgh Univ., Pa. Center for Multivariate Analysis.

OPTIMALITY ROBUSTNESS OF TESTS IN TWO POPULATION PROBLEMS

Takeaki Kariya and Bimal K. Sinha Aug. 1985 17 p

(Contract F49620-85-C-0008)

(AD-A162265; TR-85-32; AFOSR-85-0979TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

The problems of testing the equality of two location parameters (without the presence of scale parameters) and the equality of two scale parameters (with or without the presence of location parameters) based on two independent samples are considered. It is shown that, under some mild conditions on the underlying distributions, the standard optimum invariant tests derived under normality or exponentiality continue to be optimum for a wide class of distributions. However, the tests are not null robust. As a technical tool, Wijsman's representation theorem is used.

Author (GRA)

N86-24339# Technion Research and Development Foundation Ltd., Haifa (Israel).

THEORY AND APPLICATIONS OF RANDOM FIELDS Final Report, 1 May 1984 - 30 Sep. 1985

Robert J. Adler Oct. 1985 16 p

(Grant AF-AFOSR-0104-84)

(AD-A162277; AFOSR-85-0987TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

The main results described in this report include: (1) A discussion of rough surfaces and their modelling by chi-squared processes and fields. Results which describe how the theory of the latter differs from the Gaussian theory; (2) A development of a new methodology for determining deviation from normality in process and field data; (3) New results on the distribution of the maxima of general Gaussian processes; and (4) Development of a new representation of generalized Gaussian fields and those fields subordinated to it via central limit theorems for additive functionals of Markov processes. GRA

N86-24340# Duke Univ., Durham, N. C. Dept. of Computer Science.

TRANSIENT SOLUTION OF ACYCLIC MARKOV CHAINS

Raymond Marie, Andrew Reibman, and Kishor Trivedi Aug. 1985 61 p

(Grant AF-AFOSR-0132-84)

(AD-A162314; CS-1984-23; AFOSR-85-0981TR) Avail: NTIS HC A04/MF A01 CSCL 12/1

Continuous time Markov chains are commonly used in system reliability modeling. Increasing system complexity and non-Markovian behavior can drastically increase the size of a Markov model's state space. Special approximation techniques and numerical methods have been introduced to reduce the resources needed to solve Markov chain models. This paper discusses a method for automatically deriving exact transient solutions of Markov chains. The solutions derived are symbolic in t. The authors' approach can also provide solutions that are symbolic in other parameters. They extend our method to include parametric sensitivity analysis of the transient solution, and to provide cumulative measures of Markov chain behavior. They present three

examples, one to show the use of our method in evaluating approximate solution techniques, one showing parametric sensitivity analysis of a large Markov model, and one demonstrating the computation of cumulative measures for an acyclic Markov reward processes. Author (GRA)

N86-24341# Brown Univ., Providence, R. I. Center for Dynamical Systems.
ASYMPTOTIC GLOBAL BEHAVIOR FOR STOCHASTIC APPROXIMATIONS AND DIFFUSIONS WITH SLOWLY DECREASING NOISE EFFECTS: GLOBAL MINIMIZATION VIA MONTE CARLO Interim Report
H. J. Kushner Apr. 1985 42 p
(Contracts DAAG29-84-K-0082; N00014-84-C-0577; Grant AF-AFOSR-0166-81; AF Proj. 2304)
(AD-A162333; AFOSR-85-1022TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

This document studies the asymptotic behavior of a system involving a sequence of random variables. GRA

N86-24342# Pittsburgh Univ., Pa. Center for Multivariate Analysis.
ON TESTS FOR SELECTION OF VARIABLES AND INDEPENDENCE UNDER MULTIVARIATE REGRESSION MODEL
T. Kariya, Y. Fujikoshi, and P. R. Krishnaiah Aug. 1985 50 p
(Contract F49620-85-C-0008)
(AD-A162382; TR-85-33; AFOSR-85-0874TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

In this paper, the authors consider various procedures for testing the hypotheses of independence of two sets of variables and certain regression coefficients are zero under the classical multivariate regression model. Various properties of these procedures and the asymptotic distributions associated with these procedures are also considered. Author (GRA)

N86-24343# North Carolina Univ., Chapel Hill. Dept. of Statistics.
RESEARCH IN STOCHASTIC PROCESSES Final Report, 1 Nov. 1981 - 31 Aug. 1985
Raymond J. Carroll, Gopinath Kallianpur, and M. R. Leadbetter Sep. 1985 80 p
(Contract F49620-82-C-0009)
(AD-A162393; AFOSR-85-1088TR) Avail: NTIS HC A05/MF A01 CSCL 12/1

The research of four principal investigators as well as the operations of the Center for Stochastic Processes was supported by this grant. Substantial research progress was made in stochastic processes and in statistical estimation and inference. More than 135 journal articles were published or accepted for publication. The work of 19 visiting scholars was supported. Author (GRA)

N86-24344# Purdue Univ., West Lafayette, Ind. Dept. of Statistics.
OPTIMUM TWO-STAGE SELECTION PROCEDURES FOR WEIBULL POPULATIONS
Shanti S. Gupta and Klaus J. Miescke Oct. 1985 12 p Prepared in cooperation with Illinois Univ., Chicago
(Contract N00014-84-C-0167; Grant AF-AFOSR-0347-85)
(AD-A162824; TR-85-30) Avail: NTIS HC A02/MF A01 CSCL 12/1

LET PI,...,PIK BE Weibull populations with a common known shape parameter, and with unknown scale parameters. The goal is to find the population with the largest scale parameter. From each population, Type II-censored obse:vations are available at two stages, where censoring at stage 1 occurs at the q-th (r-th) failure. Two-stage procedures with screening at the first stage are considered which are optimum permutation invariant in terms of the risk with respect to a large class of loss functions. For the procedure with a fixed subset size at stage 1, the least favorable parameter configuration under the indifference zone approach is of the slippage type, which makes it feasible to control the infimum of the probability of a correct selection. Some extensions of the results are discussed at the end. Author (GRA)

N86-24345# North Carolina Univ., Chapel Hill. Center for Stochastic Processes.
PRODUCT STOCHASTIC MEASURES
Victor Perez-Abreu Oct. 1985 30 p
(Contract F49620-85-C-0144)
(AD-A162833; TR-118; AFOSR-85-1178TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

The concept of symmetric tensor product of a Hilbert space is used to construct a product measure of orthogonally scattered measures. The result is applied to the construction of an sq L-valued product stochastic measure (p.s.m.) of non-identically distributed sq-L-valued independently scattered measures. Using the theory of vector valued measures we construct multiple integrals with respect to the p.s.m. A relationship between the theory of multiple stochastic integrals and the theory of vector valued measures is established. GRA

N86-24346# Purdue Univ., West Lafayette, Ind. Dept. of Statistics.
EMPIRICAL BAYES RULES FOR SELECTING GOOD BINOMIAL POPULATIONS, REVISION
Shanti S. Gupta and TaChen Liang Oct. 1985 24 p
(Contract N00014-84-C-0167)
(AD-A162867; TR-84-37-Rev) Avail: NTIS HC A02/MF A01 CSCL 12/1

This paper deals with the problem of selecting good binomial populations compared with a standard or a control through the empirical Bayes approach. Two cases have been studied: one with the prior distribution completely unknown and the other with the prior distribution symmetrical about $p = 1/2$, but otherwise unknown. In each case, empirical Bayes rules are derived and their rates of convergence are shown to be of order $O(\exp(-cn))$ for some $c > 0$, where n is the number of accumulated post experiences at hand. Author (GRA)

N86-24388# Joint Publications Research Service, Arlington, Va.
ESTIMATES OF NUMBER OF BOOLEAN COMPARISON OPERATIONS FOR ORDER STATISTICS Abstract Only
V. V. Ivanov and V. N. Korzhova *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-004) 7 Feb. 1986 p 76 Transl. into ENGLISH from Doklady Akademii Nauk Ukrainskoy SSR. Seriya A. Fiziko-Matematicheskiye I Tekhnicheskiye Nauki (Kiev, USSR), no. 3, Mar. 1985 p 59-62 (For primary document see N86-24358 14-70)
Avail: NTIS HC A06

N86-24389# Joint Publications Research Service, Arlington, Va.
DEGREE OF DYNAMIC CORRELATION AND THE PROBLEM OF DETERMINING THE DYNAMIC NATURE OF RANDOM PROCESSES Abstract Only
Yu. A. Kravtsov and V. S. Etkin *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-004) p 80 Transl. into ENGLISH from Radiotekhnika I Elektronika (Moscow, USSR), v. 29, no. 12, Dec. 1984 p 2358-2364 (For primary document see N86-24358 14-70)
Avail: NTIS HC A06

N86-24544*# Calhoun Community Coll., Decatur, Ala.
SIMULATION AND STUDY OF SMALL NUMBERS OF RANDOM EVENTS
Russell D. Shelton *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 20 p (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 12A

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N86-24347*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

PERFORMANCE TRADEOFFS IN STATIC AND DYNAMIC LOAD BALANCING STRATEGIES Final Report

M. Ashraf Iqbal, Joel H. Saltz, and Shahid H. Bokhart Mar. 1986 25 p refs Submitted for publication

(Contracts NAS1-17070; NAS1-18107)

(NASA-CR-178073; ICASE-86-13; NAS 1.26:178073) Avail: NTIS HC A02/MF A01 CSCL 12B

The problem of uniformly distributing the load of a parallel program over a multiprocessor system was considered. A program was analyzed whose structure permits the computation of the optimal static solution. Then four strategies for load balancing were described and their performance compared. The strategies are: (1) the optimal static assignment algorithm which is guaranteed to yield the best static solution, (2) the static binary dissection method which is very fast but sub-optimal, (3) the greedy algorithm, a static fully polynomial time approximation scheme, which estimates the optimal solution to arbitrary accuracy, and (4) the predictive dynamic load balancing heuristic which uses information on the precedence relationships within the program and outperforms any of the static methods. It is also shown that the overhead incurred by the dynamic heuristic is reduced considerably if it is started off with a static assignment provided by either of the other three strategies. Author

N86-24348# Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.

A LAGRANGE MULTIPLIER/SEGMENT PROCEDURE FOR SOLUTION OF THREE-DIMENSIONAL CONTACT PROBLEMS Contract Report, Jan. - Aug. 1984

A. B. Chaudhary and K. J. Bathe Oct. 1985 76 p

(Contract DAAK11-84-K-0015; DA Proj. 1L1-61102-AH-43)

(AD-A161838; BRL-CR-544) Avail: NTIS HC A05/MF A01 CSCL 12/1

A solution procedure for finite element analysis of three-dimensional contact conditions is presented. The area of contact can vary, frictional conditions are included using Coulomb's law of friction and static or dynamic conditions can be considered. Various sample solutions are presented to demonstrate the applicability of the solution algorithm. GRA

N86-24349# Illinois Univ., Urbana. Coordinated Science Lab.

PARAMETER ESTIMATION FOR THE CLASS A MIDDLETON MODEL M.S. Thesis

Serena M. Zabin Jul. 1985 97 p

(Contracts N00014-81-K-0014; N00014-84-C-0149)

(AD-A161916; UILU-ENG-85-2223; R-1048) Avail: NTIS HC A05/MF A01 CSCL 20/1

The principal aim of this study is to propose an estimator of the parameters of the Class A impulsive noise model with desirable asymptotic properties, namely, consistency and asymptotic efficiency. Four estimators are proposed and analyzed. The inherent drawbacks of using some classical estimators to estimate the Class A parameters are identified and explained. In particular, a consistent, asymptotically normal, and asymptotically unbiased estimator of the model parameters which can be implemented easily is established via the method of moments. Though an analysis of the relative mean-norm error reveals this estimator's inefficiency, its use as a first approximation leads to a consistent and asymptotically efficient estimator (Moment/Newton-step procedure) of the parameters of the Class A model. GRA

N86-24350# Cornell Univ., Ithaca, N.Y.

SIGNIFICANT FACTOR IDENTIFICATION USING DISCRETE SPECTRAL METHODS Interim Technical Report, 31 Mar. - 25 Aug. 1984

Paul J. Sanchez and Lee W. Schruben Mar. 1985 81 p

(Contract N00014-81-K-0037)

(AD-A161933; TR-654) Avail: NTIS HC A05/MF A01 CSCL 12/1

Discrete event simulations are computer models of complex systems. The accuracy of the model in reflecting the behavior of the real system is determined by, among other things, the values of parameters for distributions used in the model. The modeller could allocate experimental resources more effectively without loss of accuracy in the model if he or she could identify those parameters to which the response of interest has the greatest sensitivity. One method of doing this is to try to model the response as a polynomial function of the model parameters. We are then interested in those terms in the polynomial which have non-zero coefficients. This report attempts to extend the Schruben/Cogliano methodology to cover a more general class of models which includes discrete-valued parameters, such as policy decisions or capacities of queues. We evaluated the use of discrete-valued functions as a basis for spectral analysis. Several function sets were considered as possibilities, and Walsh functions were selected as the best choice. GRA

N86-24351# Iowa Univ., Iowa City.

SPECIFICATION FOR MIDAS-GR. MANAGEMENT OF INFORMATION FOR DESIGN AND ANALYSIS OF SYSTEM. GENERALIZED RELATIONAL MODEL Interim Technical Report, Jul. - Dec. 1984

J. S. Arora and S. Mukhopadhyay 3 Dec. 1984 92 p

(Grant AF-AFOSR-0322-82)

(AD-A162086; CAD-SS-84.24; AFOSR-85-1062TR) Avail: NTIS HC A05/MF A01 CSCL 09/2

This report presents specification of a database management system currently under development. It is specifically designed to meet the requirements of engineering applications. The stress in design lies on the flexibility of data definition capabilities, efficient management of large volume of I/O, and dynamic creation and deletion of data objects. In data definition the system takes unified approach for relational and numerical data models. It also defines a set of frequently used special data types (sparse matrix etc.) and provides uniform data structure for their efficient manipulation. The system also provides powerful data language which can be used directly from a terminal on ad hoc basis or from a host programming language. This language is non-procedural; so for a large class of problems user need not resort to branching or loops. Also, since it is precompiled instead of being interpreted at run time, it is inherently much faster. It is expected that this system will play central role in design and implementation of future systems in design optimization area. Author (GRA)

N86-24352# SRI International Corp., Menlo Park, Calif. Artificial Intelligence Center.

RESEARCH ON PROBLEM-SOLVING SYSTEMS Interim Report, 1 Oct. 1984 - 30 Sep. 1985

David E. Wilkins 22 Oct. 1985 26 p

(Contract F49620-85-K-0001)

(AD-A162095; AFOSR-85-1091TR) Avail: NTIS HC A03/MF A01 CSCL 12/2

Research on planning and problem-solving systems was begun at SRI International in September 1979 under AFOSR sponsorship. The present report describes the research conducted during the past year. This program developed powerful methods of representing, generating, and executing hierarchical plans that contain parallel actions. Execution involves monitoring the state of the world and, possibly, replanning if things do not proceed as expected. Over the last few years SRI has designed and implemented a system, called SIPE (System for Interactive Planning and Execution Monitoring), the purpose of which is to demonstrate the heuristic adequacy of our approach to this problem. SRI's basic approach is to work within the heuristic-planning methodology, representing plans in procedural networks - as has been done in NOAH7 and other systems. Several extensions of previous planning systems have been implemented, including the development of a perspicuous formalism for describing operators and objects, the use of constraints for the partial description of objects, the creation of mechanisms that permit concurrent exploration of alternative plans, the incorporation of heuristics for reasoning about resources, and an implementation of a deductive capability. Research this year has concentrated on interfacing the abstract, high-level plans

produced by SIPE with the low-level information used by the sensors and effectors that might interact with the real world (e.g., those installed on a robot vehicle). This has compelled us to add extensions to SIPE. GRA

N86-24543*# Alabama Univ., Huntsville. Dept. of Mathematics.
MISSION ANALYSIS FLOW SEQUENCING OPTIMIZATION
McKinley Scott *In* NASA. Mɛ.shall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 14 p refs (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 12B

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N86-24353# Pittsburgh Univ., Pa. Inst. for Computational Mathematics and Applications.
THE APPLICATION OF A SEQUENCE NOTATION TO THE DESIGN OF SYSTOLIC COMPUTATIONS
Rami Melhem Oct. 1985 49 p
(Contract N00014-85-K-0339)
(AD-A161972; ICMA-85-87) Avail: NTIS HC A03/MF A01 CSCL 09/2

The sequence notation suggested in an earlier work provides a tool for the clear and precise specification of systolic computations. Namely, it separates the static and dynamic levels of the specification. At the static level, the topology of the network and the function of each cell are described by a system of causal equations on sequences, and at the dynamic level, the data flow is described by the elements of the individual sequences. This paper describes a method for the transformation of a given algorithm into a system of causal sequence equations/input-output description which specifies a systolic computation. The basic idea of the method is to pack arrays of variables along one or more dimensions into sequences. Doing this, however, may result in a system of equations that is not causal, and hence, a transformation of indices in the original algorithm may be essential in order to guarantee causality (the positive increment of time). GRA

N86-24354# Florida Univ., Gainesville.
APPLICATIONS OF DIFFERENTIAL TOPOLOGY TO GRID GENERATION Final Report, 1 Jun. 1983 - 31 May 1984
D. C. Wilson 25 Nov. 1985 46 p
(Grant AF-AFOSR-0158-83)
(AD-A162834; AFOSR-85-1165TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

The purpose of this paper is to indicate how smoothing techniques from Differential Topology can be applied to the area of algebraic grid generation in Computational Fluid Dynamics. The basic method is to patch together one global grid from a number of smaller ones. The smoothing theory allows one to blend the grid from one section into the grid of an adjacent one.
Author (GRA)

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N86-24355# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
A RELATIVE-MOTION MICROWORLD M.S. Thesis
Linda E. Morecroft Sep. 1985 249 p
(Contract N00014-83-K-0125)
(AD-A161856; MIT/LCS/TR-347) Avail: NTIS HC A11/MF A01 CSCL 05/9

A relative-motion microworld has been designed to aid high-school students in understanding the concepts of relative motion and frames of reference. Relative motion and frames of reference are usually introduced in a high-school physics or mathematics course. Most students, and many teachers too, have difficulty understanding the concepts and applying them to solve problems. The traditional approach to relative motion uses vector algebra. However, vector terminology is complex. The relative-motion uses a new representation for thinking about motion, based on the intrinsic, local and procedural characteristics of turtle geometry. This representation provides the student with a simple framework for understanding motion and relative motion, that overcomes the problems associated with the traditional approach. The microworld allows students to set up their own motion problems, in order to view the motion from different reference frames. Four key primitives have been designed: these make an object, give an object a motion, select a reference frame, and move all the objects that have been set up. These four primitives are the building blocks that can be used to set up complex problems. Problems from a variety of motion situations can be explored using the relative-motion microworld. These include rectilinear motion, non-parallel rectilinear motion, motion under gravity, and rotational motion. A student text and teacher's reference manual accompany the microworld. GRA

N86-24356# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
LA RECHERCHE AEROSPATIALE, BIMONTHLY BULLETIN, NUMBER 1985-2, 225/MARCH-APRIL
Claude Sevestre, ed. ESA Dec. 1985 80 p refs Transl. into ENGLISH of La Recherche Aerospatiale, Bulletin Bimestriel (Paris, France), No. 1985-2, 225/Mar.-Apr. 1985
(ESA-TT-925) Avail: NTIS HC A05/MF A01; print copy in ENGLISH available at ONERA, Paris FF 70; original report in FRENCH available at ONERA, Paris FF 70

Parametric modeling and radar signal processing; grid optimization for computing high Reynolds number viscous flows; computation of unsteady transonic flows with an implicit numerical method for solving the Euler equations; local effects in mechanics; a capacity comet dust detector for the Giotto space probe to Halley's comet (Capacitor Impact Sensor); and noise generated by a stretching vortex are discussed. Author (ESA)

N86-24357# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
LA RECHERCHE AEROSPATIALE, BIMONTHLY BULLETIN, NUMBER 1985-3, 226/MAY-JUNE
Claude Sevestre, ed. ESA Dec. 1985 61 p refs Transl. into ENGLISH of La Recherche Aerospatiale, Bulletin Bimestriel (Paris, France), No. 1985-3, 226/May-Jun. 1985
(ESA-TT-937) Avail: NTIS HC A04/MF A01; print copy in ENGLISH available at ONERA, Paris FF 70; original report in FRENCH available at ONERA, Paris FF 70

Characterization of moving targets by radar signature; multiprocessor systems for parallel numerical applications; multidomain method for the Euler equations application to overlapping subdomains; modeling of edge effects in a multilayer composite plate; effect of fiber orientation near the free edge of a laminated plate; and streaklines for an unsteady flow are discussed. Author (ESA)

N86-24358# Joint Publications Research Service, Arlington, Va.
USSR REPORT: PHYSICS AND MATHEMATICS
7 Feb. 1986 101 p Transl. into ENGLISH from various Russian articles
(JPRS-UPM-86-004) Avail: NTIS HC A06

Research in physics and mathematics is high lighted. Topics covered in this U.S.S.R. report include: acoustics; crystals; laser glasses and semiconductors; gas dynamics; fluid dynamics; high-temperature physics; lasers; magnetohydrodynamics; molecular physics; nuclear physics-optics; and spectroscopy; plasma physics; technical physics; thermodynamics; logic and game theory; numerical analysis and algorithms; probability and statistics; control theory; operations research; and differential equations. For individual titles, see N86-24359 through N86-24389.

N86-24359# Joint Publications Research Service, Arlington, Va.
AMPLIFICATION OF ACOUSTIC PERTURBATIONS DURING REFLECTION FROM CRITICAL LAYER IN SUPERSONIC FLOWS Abstract Only **c71**
P. I. Kolykhalov *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-004) 7 Feb. 1986 p 1 Transl. into ENGLISH from Doklady Akademii Nauk SSSR (Moscow, USSR), v. 280, no. 1, Jan. 1985 p 95-98 Original language document was announced in IAA as A85-24181 (For primary document see N86-24358 14-70)
Avail: NTIS HC A06

The paper is concerned with the propagation of acoustic perturbations in a medium moving at a variable velocity. It is shown that on reflection from the critical layer (i.e., the layer where the flow velocity is equal to the phase velocity of the perturbations), the perturbation amplitude increases if the change of flow velocity on scales of the order of the perturbation wavelength exceeds the velocity of sound. V.L. (IAA)

N86-24360# Joint Publications Research Service, Arlington, Va.
RESISTANCE OF YAG:Nd SUP 3+ LASER FREQUENCY CONVERTERS TO IONIZING RADIATION Abstract Only **c76**
B. I. Zakharkin, L. A. Kulevskiy, V. N. Nikolayev, and G. N. Toropkin *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-004) 7 Feb. 1986 p 3 Transl. into ENGLISH from Akademiya Nauk SSSR Inst. Obshchey Fiziki (Moscow, USSR), no. 58 (For primary document see N86-24358 14-70)
Avail: NTIS HC A06

This study presents a review of published work on the radiation resistance of YAG:Nd sup 3+ laser frequency converters, and describes the results of experiments on the influence of gamma-irradiation of nonlinear crystals on the output characteristics of YAG:Nd sup 3+ lasers with second-harmonic generation inside or outside the cavity. The influence of radiation on the optical properties of nonlinear crystals is investigated. It is found that radiation degrades the generation of optical harmonics in YAG:ND sup 3+ lasers employing nonlinear elements made of SDA, DSDA, LiIO3 and DKDR crystals, starting at doses of 10 to the 5th power - 10 to the 6th power rad. Deuterized nonlinear crystals are found to be more resistant to ionizing radiation. Author

N86-24361# Joint Publications Research Service, Arlington, Va.
RAMAN SCATTERING OF LIGHT IN GALLIUM-ARSENIDE CRYSTALS EXPOSED TO SUBNANOSECOND LASER PULSES Abstract Only **c76**
I. I. Reshina, O. V. Smolskiy, and A. N. Vasilyev *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-004) 7 Feb. 1986 p 4 Transl. into ENGLISH from Fizika I Tekhnika Poluprovodnikov (Leningrad, USSR), v. 19, no. 2, Feb. 1985 p 252-256 (For primary document see N86-24358 14-70)
Avail: NTIS HC A06

Raman scattering and reflection in the visible region of the spectrum are used to investigate single-crystal laser-amorphized gallium-arsenide. The thickness of the amorphous layer and the quality of the recrystallized material are determined as a function of the crystallographic orientation of the target and the laser energy. The specimens were irradiated by a single second-harmonic pulse from a YaG:Nd sup 3+ laser (lambda = 532 nm). The irradiation produced a spot 1 - 2 nm in diameter on the surface of the specimen within which from 1 to 3 annular regions with slightly different brightness could be observed. The light peripheral ring was found to characterize the region of the amorphous phase, which has a slightly larger reflection coefficient than the crystalline phase. The combined measurements of reflection and Raman scattering spectra made it possible to identify the regions of amorphous and crystalline phases in GaAs crystals with different orientation. It is hypothesized that an amorphous layer exists beneath the recrystallized layer. Author

N86-24362# Joint Publications Research Service, Arlington, Va.
LACK OF CORRESPONDENCE OF LATTICE PERIODS AND INTENSITY OF PHOTOLUMINESCENCE IN GInSbAs/GaSb HETEROCOMPOSITIONS Abstract Only **c76**
N. A. Bert, V. I. Vasilyev, S. G. Konnikov, V. I. Kuchinskiy, A. S. Lazutka, V. A. Mishurnyy, and Ye. L. Portnoy *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-004) 7 Feb. 1986 p 5 Transl. into ENGLISH from Pisma Zhurnal Tekhnicheskoy Fiziki (Leningrad, USSR), v. 11, no. 4, 26 Feb. 1985 p 193-196 (For primary document see N86-24358 14-70)
Avail: NTIS HC A06

The influence of lattice discrepancy of luminescence efficiency in G a sub (1-x)I n sub (x)S b sub (1-y)A s usb y/GaSb heterocompositions is investigated. Photoluminescence was investigated by using a specimen with a specimen with a heteroepitaxial layer 1.5 micro m thick that passed only a small amount of the driving radiation to the substrate. It is found that the absence of dislocations is not enough to obtain efficient luminescence in compositions with a comparatively wide range of pseudomorphic growth, which significantly narrows the possibility of reducing the level of residual elastic stresses in heterocompositions intended for use in radiating devices. Author

N86-24363# Joint Publications Research Service, Arlington, Va.
BLEACHING EFFECT IN ALKALI-HALIDE CRYSTALS WITH ELECTRON COLOR CENTERS Abstract Only **c76**
B. A. Medvedev, T. G. Silkina, and G. V. Simonenko *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-004) 7 Feb. 1986 p 6 Transl. into ENGLISH from Optika I Spektroskopya (Leningrad, USSR), v. 57, no. 6, Dec. 1984 p 1026-1028 (For primary document see N86-24358 14-70)
Avail: NTIS HC A06

Laser media with two types of color centers connected by radiative and non-radiative energy transfers are investigated. Alkali-halide crystals containing two types of color centers with overlapping absorption and luminescence bands in a LiF crystal are examined. The real center is approximated by four energy levels, including the laser pumping exciting centers (1), and the luminescence of centers (1) and pumping centers (2). Balance equations and Maxwell equations describing the processes occurring in this system are derived. The contour of the absorption (amplification) line in a bleaching channel is investigated. The findings expand the capabilities of nonlinear high-resolution spectroscopy of multicomponent systems, and make it possible to optimize the parameters of existing binary dye lasers and color center lasers. Author

N86-24364# Joint Publications Research Service, Arlington, Va.
EFFICIENCY OF COMPRESSED GAS ENERGY CONVERSION TO LASER RADIATION Abstract Only **c34**
V. V. Breyev and V. P. Panchenko *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-004) 7 Feb. 1986 p 8 Transl. into ENGLISH from Teplofizika Vysokikh Temperatur (Moscow, USSR), v. 22, no. 6, Nov. - Dec. 1984 p 1196-1199 (For primary document see N86-24358 14-70)
Avail: NTIS HC A06

This study investigates the use of a series of reservoirs in which gas is heated by passing from one reservoir to the next as an auxiliary heat source for a gas dynamic laser. The characteristics and efficiency of such a laser system are assessed. It is found that the coefficient of conversion of compressed gas energy to laser radiation can be as high as approximately 10-2 % for a helium mixture, and approximately half that for an air mixture (CO2 + N2 + 02 + H20), because of the low energy transmission factor in the system of reservoirs. The findings, while not optimum, provide a clear idea of the characteristic efficiency value of the system and its components. Author

N86-24365# Joint Publications Research Service, Arlington, Va.
SHOCKWAVE PROPAGATION IN TRANSVERSE GLOW DISCHARGE PLASMA IN ARGON Abstract Only **c34**
I. V. Basargin and G. I. Mishin *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-004) 7 Feb. 1986 p 9 Transl. into ENGLISH from Pisma V Zhurnal Tekhnicheskoy Fiziki (Leningrad, USSR), v. 11, no. 4, 26 Feb. 1985 p 209-214 Previously announced in IAA as A86-13886 (For primary document see N86-24358 14-70)
Avail: NTIS HC A06

Shock waves traveling perpendicularly to a glow discharge in an Ar plasma and Ar with no plasma were observed experimentally to examine the dissipation of shock wave energy. A piezoelectric gage attached to a quartz rod furnished the pressure pulse data by which the shock velocities could be monitored at two points in the ambient medium. The shock wave propagated almost three times as fast in the plasma. No connection was found between the speed-up of a shock and decreases in the shock wave amplitude. A correlation was found between the radial change in the shock velocity and the radial electron temperature profile. It is concluded that ion acoustic waves forming ahead of the shock induce an acceleration of the neutral particles and thereby an increase in the velocity of the shock wave. M.S.K. (IAA)

N86-24366# Joint Publications Research Service, Arlington, Va.
THERMAL FEATURES OF SUPERSONIC GAS FLOW Abstract Only **c34**
G. Ye. Skvortsov and N. Yu. Vasilyev *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-004) 7 Feb. 1986 p 10 Transl. into ENGLISH from Zhurnal Tekhnicheskiy Fiziki (Leningrad, USSR), v. 55, no. 1, Jan. 1985 p 230-232 (For primary document see N86-24358 14-70)
Avail: NTIS HC A06

The features of a steady-state gas flow with thermal factor governed by the physical-chemical conversions or the direct action of heat on the stream are investigated. Flow instability is detected for a certain cooling level, and an interpretation of recent experiments on shockwave propagation in a glow discharge plasma is presented. An anomaly noted during cooling, which corresponds to possible shockwave instability, is discussed. Author

N86-24367# Joint Publications Research Service, Arlington, Va.
INTERACTION OF GENERATORS WITH EXCITATION AND THE PROBLEM OF TURBULENCE Abstract Only **c34**
P. S. Landa and S. M. Perminov *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-004) 7 Feb. 1986 p 12 Transl. into ENGLISH from Izvestiya Vysshikh Uchebnykh Zavedeniy Fizika (Tomak, USSR), v. 27, no. 11, Nov. 1984 p 22-25 Original language document was announced in IAA as A85-22457 (For primary document see N86-24358 14-70)
Avail: NTIS HC A06

A turbulence-generation model is proposed which explains the appearance of complex quasi-periodic motion with a practically continuous spectrum after several bifuractions. It has been shown that turbulence excitation is rigid, i.e., that there exists a wide Reynolds-number range in which laminar flow is stable with respect to small perturbations and is unstable with respect to finite-amplitude perturbations. Hence, there is reason to consider the set of potentially excitable modes as a set of coupled rigid-excitation generators, for some of which self-excitation conditions are satisfied. It is shown that asynchronous excitation of underexcited generators can occur in such a system, which is analogus to the asynchronous excitation of a single rigid-excitation generator subjected to an external force at a nonresonant frequency.
B.J. (IAA)

N86-24368# Joint Publications Research Service, Arlington, Va.
A GROUP OF OPERATORS OCCURRING IN THE DYNAMICS OF A COMPRESSIBLE STRATIFIED FLUID Abstract Only **c34**
S. A. Gabov and K. S. Mamedov *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-004) 7 Feb. 1986 p 14 Transl. into ENGLISH from Doklady Akademii Nauk SSSR (Moscow, USSR), v. 280, no. 1, Jan. 1985 p 23-26 (For primary document see N86-24358 14-70)
Avail: NTIS HC A06

Small movements of a compressible stratified fluid are investigated in a Cartesian system of coordinates (x sub 1, x sub 2, x sub 3). The fluid is assumed to be exponentially stratified along the x sub 3 axis, i.e., its density in the unperturbed state is assumed to be a function of x sub 3 alone. Boundary conditions are derived for the equation describing small movements of this fluid in a gravitational field. An eigenvalue problem (a problem of normal oscillations) is derived that reduces in an equivalent fashion to a group of operators in which the operator S is only bounded, and not entirely continuous, as was assumed in previous studies. It is found that the condition of strong spectral decoupling is always satisfied in cases of practical interest involving the sound propagation velocity in water. Author

N86-24369# Joint Publications Research Service, Arlington, Va.
COMBUSTION IN TURBULENT BOUNDARY LAYER FOLLOWING SHOCK WAVE Abstract Only **c34**
I. N. Zvyeryev, M. I. Ramodanov, and T. V. Ramodanova *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-004) 7 Feb. 1986 p 16-17 Transl. into ENGLISH from Vestnik Moskovoskogo Univ. Seriya 1: Matematika, Mekhanika (Moscow, USSR), no. 2, Mar. - Apr. 1985 p 52-55 (For primary document see N86-24358 14-70)
Avail: NTIS HC A06

The temperature in the chemically reacting turbulent boundary layer following a shock wave is calculated in the presence of evaporation of fuel from the walls and combustion of the vapors within the boundary layer. A two-layer turbulent layer is assumed in which the Prandtl and Schmidt numbers, as well as their turbulenct analogs, are equal to unity. The coefficient of diffusion of the multicomponent mixture is replaced with the coefficient of a binary mixture consisting of the initial reagents and the final combustion products. It is found that practically no combustion develops in the laminar sublayer. The temperature profiles exhibit clearly defined extrema that correspond to the most intense combustion. The maximum temperature practically stops increasing in a nonself-similar boundary layer at a certain distance from the shock wave front that depends upon the shock wave velocity, indicating that the chemical reactions become less intense as the longitudinal coordinate x increases. Author

N86-24370# Joint Publications Research Service, Arlington, Va.
LOCALIZATION AND THERMAL STABILITY OF DEFECTS CAUSED BY LASER RADIATION OF GERMANIUM Abstract Only **c76**
P. K. Kashkarov and A. V. Petrov *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-004) 7 Feb. 1986 p 18 Transl. into ENGLISH from Fizika I Tekhnika Poluprovodnikov (Leningrad, USSR), v. 19, no. 2, Feb. 1984 p 234-236 (For primary document see N86-24358 14-70)
Avail: NTIS HC A06

This study investigates the localization and thermal stability of charge carrier recombination and trapping centers occurring in the surface layers of germanium when high-resistance single crystals are irradiated by nanosecond pulses from a neodymium laser. The surface of (111) high-resistance single crystals of n-type germanium etched in H2O2 at 310 K was examined. Irradiation was provided by a monopulse neodymium Q-switched laser. It is suggested that defect generation during laser irradiation below 10 MW/sq cm is associated with electron-vibrational excitation of the trapping centers and radiationless recombination of nonequilibrium charge carriers. This excitation may change the properties of existing defects, and also lead to the occurrence of new centers. It is found that different systems of centers are responsible for surface recombination and trapping of charge carriers. Author

N86-24371# Joint Publications Research Service, Arlington, Va.
INFLUENCE OF LASER RADIATION WAVELENGTH ON PARAMETERS OF FORMING PLASMA Abstract Only **c75**
A. V. Dobkin and I. V. Nemchinov *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-004) 7 Feb. 1986 p 24 Transl. into ENGLISH from Pisma V Zhurnal Tekhnicheskoy Fiziki (Leningrad, USSR), v. 10, no. 23, 12 Dec. 1984 p 1426-1430 (For primary document see N86-24358 14-70)
Avail: NTIS HC A06

A wide range of laser radiation quantum energies epsilon sub 0 = 1 - 300 eV is investigated for moderate flux densities (10 to the 8th power - 10 to the 10th power w/sq cm.) and durations of up to 0.1 - 1 micro sec in support of a theoretical study of the processes underlying the interaction of monochromatic radiation

at different wavelengths with a barrier. Inverse brehmsstrahlung is found to be the dominant mechanism for longwave radiation. The absorption of harder radiation by vapor at low temperatures is determined by photoionization. In the constant-mass heating condition, the plasma temperature is found to increase rapidly; as the quantum energy increases the plasma temperature drops and the pressure increases on the surface of the obstacle. The estimates and numerical calculations indicate that the plasma parameters vary nonmonotonically as the laser radiation quantum energy. Author

N86-24372# Joint Publications Research Service, Arlington, Va.
WORK ON FEMTOSECOND LASERS AT VILNYUS UNIVERSITY VIEWED Abstract Only **c36**
Algis Piskarskas *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-004) 7 Feb. 1986 p 27 Transl. into ENGLISH from KomsomolskayaPravda (Moscow, USSR), no. 1, 1 Jan. 1985 p 1 (For primary document see N86-24358 14-70)
Avail: NTIS HC A06

Advances in shortening the duration of laser pulses from the nanosecond to picosecond to femtosecond ranges at the laser research center of Vil'nyus University over the past 20 years are reviewed. Physicists, mathematicians, chemists, biologists, and medical personnel are all involved in the development of lasers for various branches of science at the university's laser research center. A picosecond laser spectrometer was developed for measuring very rapid jumps of electrons, for example. The speed of electrons over a distance of 20 angstroms reportedly has been measured with this instrument. Personnel of the center have been using computers in work on laser methods for studying crystals in which electron jumps occur that are still more rapid, the author relates. A femtosecond parametric laser employing new crystals and pumping sources has been designed for this purpose. Such a unit is capable of emitting a pulse only 200 femtoseconds in duration. Author

N86-24373# Joint Publications Research Service, Arlington, Va.
NUMERICAL MODELING OF CHARACTERISTICS OF CO-2 WAVEGUIDE LASER Abstract Only **c36**
Yu. B. Konev, N. I. Lipatov, P. P. Pashinin, and A. M. Prokhorov *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-004) 7 Feb. 1986 p 30 Transl. into ENGLISH from Akademiya Nauk SSSR Inst. Obshchey Fiziki (Moscow, USSR), no. 44 (For primary document see N86-24358 14-70)
Avail: NTIS HC A06

The characteristics of the linear amplification mode, as well as the lasing mode, of typical CO2 waveguide lasers are modeled numerically assuming no degradation of the working mixture of the laser during the discharge process. The modeling is based on balance equations for the average number of vibrational quanta, taking into account the flow of quanta to levels above the minimum of the trinor distribution function of the asymmetrical mode of the CO2 molecule. The assumption of severe degradation of the working mixture of the laser when pumping power densities are high results in a divergence between theoretical and experimental results. The influence of the diameter of the discharge channel on the lasing power is insignificant for a helium-rich 1:1:8 mixture; however, a 1.5-mm waveguide is found to provide approximately 20% higher lasing power mixture. Author

N86-24374# Joint Publications Research Service, Arlington, Va.
LASER WITH DYNAMIC DISTRIBUTED FEEDBACK FORMED BY COUNTER-PROPAGATING PUMPING BEAMS Abstract Only **c36**
M. V. Bondar, L. V. Vovk, Ya. I. Zabello, and Ye. A. Tikhonov *In its* USSR Report: Physics and Mathematics (JPRS-PUM-86-004) 7 Feb. 1986 p 31 Transl. into ENGLISH from Ukrainskiy Fizicheskiy Zhurnal (Kiev, USSR), v. 29, no. 7, 1984 p 988-993 (For primary document see N86-24358 14-70)
Avail: NTIS HC A06

The effectiveness of dynamic distributed feedback formed by the interference between two waves in the active medium is investigated in cavity lasers. The characteristics of distributed feedback lasers employing counter-propagating pumping beams are compared with those of lasers employing following beams. The latter are found to provide significant advantages in gain, lasing line width and emission divergenece. A scheme is developed in which the lasing wavelength is relatively independent of uncontrollable temperature fluctuations and mechanical vibration and in which the delay between the interfering beams is small, permitting the use of ultrashort pumping pulses. This scheme is useful for exploratory experiments on dynamic periodic structures and for working with media having small optical densities at the pumping frequencies. Author

N86-24375# Joint Publications Research Service, Arlington, Va.
INFLUENCE OF GEOMETRY OF ACTIVE ELEMENT ON RADIATION PARAMETERS OF GAS-DISCHARGE LASERS Abstract Only **c36**
V. Ye. Privalov and Ye. G. Chulyayeva *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-004) 7 Feb. 1986 p 34 Transl. into ENGLISH from Optika I Spektroskopiya (Leningrad, USSR), v. 57, no. 6, Dec. 1984 p 1056-1059 (For primary document see N86-24358 14-70)
Avail: NTIS HC A06

A model is proposed for the radiation frequency shift of a helium-neon laser as a function of the pressure and composition of the mixture that explains the influence of the geometry of the active element on the frequency shift. The gas separation effect is interpreted as causing frequency shifts in helium-neon lasers, with the main role being played by the distribution of the neon along the discharge, rather than the distribution of the overall pressure or partial pressure of the helium. Measurements performed by optically heterodyning the radiation from two lasers with neon absorption cells to validate the model are described. The use of the same scheme to investigate shifts in the center of the Doppler neon contour as a function of helium pressure is explained. It is confirmed that the main contribution to the frequency shift comes from redistribution of the partial pressure of the neon along the discharge, so that the wavelengths of helium-neon lasers that are stabilized by the characteristic points of the Doppler radiation contour can differ, even with the same filling pressure. A pressure of about 800 Pa is recommended for filling the absorption cells in stabilized lasers. Author

N86-24376# Joint Publications Research Service, Arlington, Va.
BLEACHING OF COLOR CENTERS IN NEODYMIUM GLASS LASER Abstract Only **c36**
M. I. Dzhibladzye, G. G. Mshvelidzye, R. R. Erikashvili, and Z. G. Esiashvili *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-004) 7 Feb. 1986 p 36 Transl. into ENGLISH from Soobshcheniya Akademii Nauk Gruzinskoy SSR (Tbilisi, USSR), v. 115, no. 2, Aug. 1985 p 265-268 (For primary document see N86-24358 14-70)
Avail: NTIS HC A06

The mechanism underlying the bleaching of short-lived color centers in a neodymium glass laser, which causes passive Q-modulation of the cavity, is investigated. Experiments to investigate the amplification of series of short-lived light pulses by neodymium glass fibers are described. It is found that the gain of the laser drops off monotonically toward the end of the pulse rain in the absence of color center, but that in the presence of color centers the micropulses at the front of the chain are amplified significantly more weakly than subsequent micropulses. It is concluded that passive Q-modulation by short-lived color centers in neodymium glass lasers results mainly from destruction by emission from the neodymium. Author

N86-24377# Joint Publications Research Service, Arlington, Va.
THRESHOLD CONDITIONS FOR IGNITION AND PROPAGATION OF OPTICAL DISCHARGE IN NEODYMIUM LASER BEAM Abstract Only **c36**
I. A. Bufetov, A. M. Prokhorov, V. B. Fedorov, and V. K. Fomin *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-004) 7 Feb. 1986 p 38 Transl. into ENGLISH from Zhurnal Tekhnicheskiy Fiziki (Leningrad, USSR), v. 55, no. 1, Jan. 1985 p 96-102

(For primary document see N86-24358 14-70)
Avail: NTIS HC A06

This study describes the experimental investigation of an optical discharge maintained by neodymium laser radiation. The development of the discharge was investigated by high speed photography of the plasma glow. The length of the discharge was determined as a function of the propagation time and velocity of the discharge fronts. The power of the incident radiation and the radiation passing through the discharge were recorded and used to find the coefficient of absorption of the plasma. It was found that the temperature of the discharge plasma is the same for all investigated diameters near the propagation threshold, because of the abrupt reduction in the stream of plasma radiation that moves the front of the discharge. The power absorbed by the discharge and the discharge plasma temperature are found to depend little upon the intensity of the incident radiation for intensities above the threshold because of the rapid drop in absorption in the plasma as the intensity increases. It is found that an optical discharge at lambda = 1.06 micro m can be sustained with powers of the order of 0.1 MW. Such low discharge thresholds make it possible to use them to obtain neodymium lasers with lasing parameters easily achievable at present. Author

N86-24378# Joint Publications Research Service, Arlington, Va.
MHD OSCILLATIONS ON PERIPHERY OF PLASMA FILAMENT IN L-2 STELLARATOR DURING OHMIC HEATING Abstract Only **c75**
S. Ye. Grebenshchikov, B. I. Kornev, and S. V. Shchepetov *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-004) 7 Feb. 1986 p 41 Transl. into ENGLISH from Akademiya Nauk SSSR, Inst. Obshchey Fiziki (Moscow, USSR), 1984 (For primary document see N86-24358 14-70)
(Preprint-178) Avail: NTIS HC A06

Fluctuations of the poloidal magnetic field in the L-2 stellarator in ohmic plasma heating modes are investigated experimentally. The field fluctuations were measured by a system of magnetic probes placed near the exterior surface of the vacuum discharge chamber. The measurements were processed automatically by computing the cross-correlation functions of the probe signals and performing Fourier-series expansion. The current density perturbations are found to be of the spiral mode (m,n) type. The poloidal and toroidal numbers of the perturbations are relatively large, and depend upon the ohmic heating current and the small radius of the plasma. The experimental findings are in complete accord with contemporary theoretical conceptions of the principles underlying the dynamics of resistive MHD instabilities in stellarators. Author

N86-24379# Joint Publications Research Service, Arlington, Va.
ROTATIONAL-VIBRATIONAL RESONANCES IN ELECTRON TRANSITION SPECTRA OF XeCl MOLECULES Abstract Only **c72**
N. G. Basov, I. S. Gorban, V. A. Danilychyev, N. C. Zubrilin, and M. G. Chernomorets *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-004) 7 Feb. 1986 p 42 Transl. into ENGLISH from Doklady Akademii Nauk SSSR (Moscow, USSR), v. 281, no. 1, Mar. 1985 p 64-66 (For primary document see N86-24358 14-70)
Avail: NTIS HC A06

The rotational structure of the energy spectrum of XeCl molecules is established, providing new information on the dynamic properties of the XeCl molecule and to measure the parameters of the potential X-state function and more accurately. The spontaneous luminescence and induced radiation spectra were obtained on two different systems - a beam system and an electric discharge system. The fine structure of the electron-vibrational bands in the spectra of spontaneous and induced emission of XeCl molecules is detected. The spectroscopic characteristics of the structure indicate the occurrence of resonant interaction between vibrational and rotational modes in the lower electron state. Author

N86-24380# Joint Publications Research Service, Arlington, Va.
INELASTIC INTERACTIONS OF HIGH ENERGY HADRONS WITH NUCLEONS AND NUCLEI OF PHOTOEMULSION AND THE CLUSTERIZATION PHENOMENON Abstract Only **c73**
Marianna Ivanovna Tretyakova *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-004) 7 Feb. 1986 p 45 Transl. into ENGLISH from Akademiya Nauk SSSR Ordena Lenina Fizicheskiy Inst. Imeni P. N. Lebedeva (Moscow, USSR), 1984 p 3-48 (For primary document see N86-24358 14-70)
Avail: NTIS HC A06

The multiple generation of particles is investigated experimentally in inelastic collisions of hadrons (protons and ions) with hadrons and nuclei in the region of accelerator energies (10-400 Gev) and cosmic rays 10 to the 3rd power - 10 to the 3rd power Gev by the nuclear photoemulsion method. Extensive information is obtained on the characteristics of inelastic interactions of hadrons over a wide range of proton and pi-meson energies. The total material analyzed comprised approximately 50,000 stars found along the trails of primary particles over a total length of about 18 km. Unique information is obtained on the multiperipheral cluster nature of inelastic processes in elementary events and on the space-time development of the formation of secondary particles and hadron structure, thus providing new information on the properties of strong interaction of elementary particles. Author

N86-24381# Joint Publications Research Service, Arlington, Va.
COMPLETE INTERACTION CROSS-SECTIONS OF ULTRACOLD NEUTRONS WITH GASEOUS DEUTERIUM Abstract Only **c73**
Ye. Z. Akhmetov, V. N. Barshentsev, M. M. Kadykenov, D. K. Kaipov, M. D. Kaipov, and N. K. Kospanov *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-004) 7 Feb. 1986 p 46 Transl. into ENGLISH from Izvestiya Akademii Nauk Kazakhskoy SSR: Seriya Fiziko-Matematicheskaya (Alma-Ata, USSR), no. 6, Nov. - Dec. 1984 p 1-2 (For primary document see N86-24358 14-70)
Avail: NTIS HC A06

The complete interaction cross-sections of ultracold neutrons moving at velocities of from 3.2 to 5.7 m/sec with gaseous deuterium are measured at 300 K (in an equilibrium mixture consisting of one-third paradeuterium and two-thirds orthodeuterium). The complete cross-sections are also analyzed for an equilibrium mixture of ortho- and para-modifications of deuterium as a function of temperature for average ultracold neutron velocity of 4.8 m/sec. The measurement results confirm the calculated cross-sections. Author

N86-24382# Joint Publications Research Service, Arlington, Va.
EXPERIMENTAL INVESTIGATION OF RADIATION SCATTERING BY MULTICOMPONENT POLYDISPERSE SYSTEMS OF PARTICLES Abstract Only **c74**
F. B. Yurevich, G. M. Yatskevich, V. A. Fogelev, and S. M. Karas *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-004) 7 Feb. 1986 p 48 Transl. into ENGLISH from Teplofizika Vysokikh Temperatur (Moscow, USSR), v. 22, no. 6, Nov. - Dec. 1984 p 1146-1151 (For primary document see N86-24358 14-70)
Avail: NTIS HC A06

An experimental setup is described for finding the relationship between the optical properties of heat protective materials on radiation wavelength, fractional composition, temperature, component concentration and other parameters. The optical properties of a three-component gas-and-dust mixture containing 36% carbon, 32% magnesium oxide and 32% silicon dioxide by weight are studied. The experimental method and software employed are described in detail. The optical properties of the gas-and-dust mixture were measured at disperse phase temperatures of 300 and 1200 K; cold-jet sounding was performed at lambda = 0.633 micrometers, and hot-jet at lambda = 0.488 micrometers. The scattering index for forward scattering is found to agree satisfactorily with the calculated values; the agreement is not as good for the Sc lambda criterion or the coefficient of asymmetry eta lambda, which confirms the suitability of the spherical particles model and the method for determining the characteristic dimensions of the

particles. The complex index of refraction is found to influence the effectiveness of screening radiation by a gas mixture through angular energy redistribution. Author

N86-24383# Joint Publications Research Service, Arlington, Va.
DIFFRACTION OF LIGHT BY ULTRASOUND IN OPTICALLY ACTIVE UNIAXIAL CRYSTALS Abstract Only c74
G. Ye. Zilberman, L. F. Kupchenko, and G. F. Goldvyanskaya *In its* USSR Report Physics and Mathematics (JPRS-UPM-86-004) 7 Feb. 1986 p 51 Transl. into ENGLISH from Radiotekhnika I Elektronika (Moscow, USSR), v. 29, no. 12, Dec. 1984 p 2449-2454 (For primary document see N86-24358 14-70)
Avail: NTIS HC A06

The diffraction of light by ultrasound is examined in uniaxial crystals exhibiting optical activity for small angles between the incident wave and the axis of the crystal (where optical activity masks diffraction phenomena) and for angles of the order of Bragg angles. Expressions are found for the fundamental and diffraction components of a light field. New Bragg angles are found that lie in the interval between the ordinary angles occurring for epsilon sub c = 0. The new Bragg angles observed differ significantly from the old values for gyration tensor component values that exceed the values for TeO2 by factors of several hundred. The nonmutual effect in the acoustic field is described; it is found that optical activity apparently does not change the order of nonmutuality. Author

N86-24384# Joint Publications Research Service, Arlington, Va.
INFLUENCE OF DESIGN PARAMETERS OF PARABOLIC MIRROR SEGMENT ON IMAGE CHARACTERISTICS IN COHERENT OPTICAL PROCESSING SYSTEM Abstract Only c74
Ye. A. Dudkina *In its* USSR Report Physics and Mathematics (JPRS-UPM-86-004) 7 Feb. 1986 p 59 Transl. into ENGLISH from Optiko-Mekhanicheskaya Promyshlennost (Leningrad, USSR), no. 7, Jul. 1984 p 26-27 (For primary document see N86-24358 14-70)
Avail: NTIS HC A06

The relationship between the design parameters of parabolic mirror segments and the characteristics of the processed image in a coherent optical processing system are investigated in order to assess the influence of individual factors (such as the wavelength of the radiation, the diameter the image being processed and the focal length of the parabolic mirror) on the image quality in the spectral plane. Formulas are derived for assessing this influence that can also be used to solve the inverse problem of finding the design parameters of the parabolic mirror and its accuracy requirements on the basis of the requirements for the image quality in the spectral plane and the characteristics of the processed image. Author

N86-24385# Joint Publications Research Service, Arlington, Va.
LASER RADIATION WAVEFRONT CONJUGATION IN FIBER OPTIC LIGHTGUIDES Abstract Only c74
A. A. Chertkov *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-004) 7 Feb. 1986 p 61 Transl. into ENGLISH from Pisma V. Zhurnal Tekhnicheskoy Fiziki (Leningrad, USSR), v. 10, no. 23, 12 Dec. 1984 p 1214-1420 (For primary document see N86-24358 14-70)
Avail: NTIS HC A06

Wavefront conjugation precision during stimulated brillouin scattering is investigated in a monofiber with spatially homogeneous and inhomogeneous beams at lambda = 106 micrometer. A Q-modulated YAG:Nd sup 3+ laser with initial transmission of 25% was employed as the radiation source. The energy of the incident and reflected radiation was measured by means of F-28 photoelements outputting their signals to an S8-12 oscilloscope. The behavior of the coefficient of reflection from the stimulated Brillouin scattering mirror as a function of the amount by which the pumping energy exceeded the threshold was found to be the same for all types of fibers, and to be independent of astigmatism and angular beam divergence. The wavefront conjugation quality as a function of the energy level was also the same for all of the lightguides employed: quartz, silicate and silicate-quartz. The good wavefront conjugation observed for astigmatic and spatially inhomogeneous beams make it possible to compensate satisfactorily for inhomogeneities in the distorting wavefront of the beam. Author

N86-24386# Joint Publications Research Service, Arlington, Va.
MAGNETIC REARRANGEMENT AND CHANGE IN PLASMA CONCENTRATION DURING DISRUPTION OF CURRENT LAYER Abstract Only c75
S. Yu. Bogdanov, G. V. Dreyden, I. I. Komissarova, V. S. Markov, G. V. Ostrovskaya, Yu. I. Ostrovskiy, V. N. Filippov, A. G. Frank, A. Z. Khodzhayev, and Ye. N. Shedova *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-004) 7 Feb. 1986 p 65 Transl. into ENGLISH from Akademiya Nauk SSSR Inst. Obshchey Fiziki (Moscow, USSR), 1984 (For primary document see N86-24358 14-70)
(Preprint-179) Avail: NTIS HC A06

The rapid breakdown of a plane current layer is investigated experimentally. Measurements of the magnetic field in the vicinity of the current layer, and of the electron concentration therein, are used to find the structure of the magnetic field, the spatial distributions of the current density, the current velocity and the average transverse particle energy in the layer, as well as their behavior over time. The magnetic field structure and current distribution within the layer are analyzed. Changes in the electron concentrations during successive stages of evolution of the current layer are explained. It is found that the abrupt breakdown of the current layer is a complex process, during which numerous characteristics change abruptly: the structure of the magnetic field and the geometry of the layer, the conductivity of the plasma, the current velocity and the characteristic energy of the particles. The process occurs in two stages. Author

N86-24387# Joint Publications Research Service, Arlington, Va.
NUMERICAL MODELING OF UNIDIMENSIONAL QUASILINEAR RELAXATION OF RELATIVISTIC ELECTRON BEAM IN INHOMOGENEOUS PLASMA WITH COLLISIONS Abstract Only c75
K. G. Gureyev, M. G. Nikulin, and A. B. Sionov *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-004) 7 Feb. 1986 p 68 Transl. into ENGLISH from Zhurnal Tekhnicheskiy Fiziki (Leningrad, USSR), v. 55, no. 1, Jan. 1985 p 215-217 (For primary document see N86-24358 14-70)
Avail: NTIS HC A06

A numerical solution is found to the problem of unidimensional quasilinear relativistic electron beam relaxation in an inhomogeneous plasma with collisions, making it possible to track the dynamics of the process and to establish the system parameter values for which the electron collisions and longitudinal inhomogeneity of the plasma density retard the beam relaxation significantly, thus increasing the transport length. The results of a calculation for an initial angular dispersion of the beam particles of 0.1 and thermal noise with spectral energy density of 10 to the minus 4 power are presented. Author

N86-24388# Joint Publications Research Service, Arlington, Va.
ESTIMATES OF NUMBER OF BOOLEAN COMPARISON OPERATIONS FOR ORDER STATISTICS Abstract Only c65
V. V. Ivanov and V. N. Korzhova *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-004) 7 Feb. 1986 p 76 Transl. into ENGLISH from Doklady Akademii Nauk Ukrainskoy SSR. Seriya A. Fiziko-Matematicheskiye I Tekhnicheskiye Nauki (Kiev, USSR), no. 3, Mar. 1985 p 59-62 (For primary document see N86-24358 14-70)
Avail: NTIS HC A06

An algorithm is investigated for finding the k-smallest sample for which the average number of Boolean (bit by bit) comparison operations is found asymptotically with respect to N, ranging from N to rho N, as a function of the distribution of the sample (where N is the sample size); the sample of numbers is assumed to be assigned as an array of nonnegative rho-bit binary integers. The first digit of the array of N numbers is compared, after which the entire array is then divided into two parts, one of which contains

the numbers with zero as the high-order (first) bit, and the other with 1. The arrays are then arranged in order from 1 to N, with the array having a first digit of 1 being the lowest. The sought digit is that occurring in the kth place. After rho steps, the k-smallest number will be in the kth place. Author

N86-24389# Joint Publications Research Service, Arlington, Va.
DEGREE OF DYNAMIC CORRELATION AND THE PROBLEM OF DETERMINING THE DYNAMIC NATURE OF RANDOM PROCESSES Abstract Only **c65**
Yu. A. Kravtsov and V. S. Etkin *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-004) p 80 Transl. into ENGLISH from Radiotekhnika I Elektronika (Moscow, USSR), v. 29, no. 12, Dec. 1984 p 2358-2364 (For primary document see N86-24358 14-70)
Avail: NTIS HC A06

The property of partial predictability of processes generated by autostochastic systems is analyzed. The generally accepted characteristic of predictability--the mean square difference between the observed and predicted processes--is employed in conjunction with a new statistical characteristic--the degree of dynamic correlation, which is characterized by the degree of statistical connection between the prediction and observation. It is shown that autostochastic systems admit prediction over a finite amount of time called the dynamic memory time. The latter is a new characteristic time of the strange attractor which is determined by instrumentation noise and random internal signals and which determines the interval of determinate (predictable) behavior of the system and can be used to discover the dynamic nature of random processes. The error in predicting autostochastic systems subjected to random forces, and the error for systems with exponential trajectory divergence are estimated. The use of the degree of dynamic correlation to discover the structure of dynamic systems is analyzed. Author

N86-23839# National Bureau of Standards, Gaithersburg, Md. Electronic Instrumentation and Metrology Electrosystems Div.
SETTLING TIME MEASUREMENTS
Howard K. Schoenwetter *In its* Digital Methods in Waveform Metrology Oct. 1985 p 87-108 refs (For primary document see N86-23833 14-33)
Avail: NTIS HC A09/MF A01 CSCL 20C

N86-23842# National Bureau of Standards, Gaithersburg, Md. Electrosystems Div.
AN APPROACH TO ATE CALIBRATION VIA PERFORMANCE VERIFICATION AT THE SYSTEM INTERFACE
Thomas F. Leedy *In its* Digital Methods in Waveform Metrology Oct. 1985 4 p refs Presented at the Measurement Science Conference, 17-18 Jan. 1985 Submitted for publication (For primary document see N86-23833 14-33)
Avail: NTIS HC A09/MF A01 CSCL 20C

71 ACOUSTICS

Includes sound generation, transmission and attenuation. For noise pollution see *45 Environment Pollution.*

N86-24390 California Univ., San Diego.
DEEP SEAFLOOR ACOUSTIC BACKSCATTERING MEASUREMENTS USING SEA BEAM Ph.D. Thesis
Christian deMoustier 1985 160 p
Avail: Univ. Microfilms Order No. DA8524565

Multibeam echo-sounders such as Sea Beam allow detailed bathymetric surveys of large areas of the seafloor. However, bathymetry only reveals the shape of seafloor features to the resolution of the sounding system, and in order to make geological interpretations the nature of the seafloor surveyed needs to be characterized. Because bottom roughness and/or variations in bottom substrate cause fluctuations in the backscattered acoustic signal received by an echo-sounder, such characteristics can be inferred in part by analyzing the structure and the variations of this signal over several transmission cycles. The approach taken was to record digitally the detected echo envelopes of the Sea Beam's 16 narrow beams over a variety of seafloor environments, and process these data to determine whether the acoustics held enough information to differentiate between bottom types. Significant results derived from these acoustic data concern the Sea Beam system's performance, its potential for mapping acoustic boundaries, and the display of the echoes received in a side looking sonar-like picture. Dissert. Abstr.

N86-24391*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
INTRODUCTION TO TIME SERIES ANALYSIS
Jay C. Hardin Mar. 1986 168 p refs
(NASA-RP-1145; L-15958; NAS 1.61:1145) Avail: NTIS HC A08/MF A01 CSCL 20A

The field of time series analysis is explored from its logical foundations to the most modern data analysis techniques. The presentation is developed, as far as possible, for continuous data, so that the inevitable use of discrete mathematics is postponed until the reader has gained some familiarity with the concepts. The monograph seeks to provide the reader with both the theoretical overview and the practical details necessary to correctly apply the full range of these powerful techniques. In addition, the last chapter introduces many specialized areas where research is currently in progress. Author

N86-24392*# Bionetics Corp., Hampton, Va.
THE RELATIVE EFFECT OF NOISE AT DIFFERENT TIMES OF DAY: AN ANALYSIS OF EXISTING SURVEY DATA
James M. Fields Washington NASA Apr. 1986 80 p refs
(Contracts NAS1-16978; DTFA01-834-10564)
(NASA-CR-3965; NAS 1.26:3965) Avail: NTIS HC A05/MF A01 CSCL 20A

This report examines survey evidence on the relative impact of noise at different times of day and assesses the survey methodology which produces that evidence. Analyses of the regression of overall (24-hour) annoyance on noise levels in different time periods can provide direct estimates of the value of the parameters in human reaction models which are used in environmental noise indices such as LDN and CNEL. In this report these analyses are based on the original computer tapes containing the responses of 22,000 respondents from ten studies of response to noise in residential areas. The estimates derived from these analyses are found to be so inaccurate that they do not provide useful information for policy or scientific purposes. The possibility that the type of questionnaire item could be biasing the estimates of the time-of-day weightings is considered but not supported by the data. Two alternatives to the conventional noise reaction model (adjusted energy model) are considered but not supported by the data. Author

N86-24393*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
CONSIDERATION OF SOME FACTORS AFFECTING LOW-FREQUENCY FUSELAGE NOISE TRANSMISSION FOR PROPELLER AIRCRAFT
John S. Mixson and Louis A. Roussos Apr. 1986 28 p refs
(NASA-TP-2552; L-14994; NAS 1.60:2552) Avail: NTIS HC A03/MF A01 CSCL 20A

Possible reasons for disagreement between measured and predicted trends of sidewall noise transmission at low frequency are investigated using simplified analysis methods. An analytical model combining incident plane acoustic waves with an infinite flat panel is used to study the effects of sound incidence angle, plate structural properties, frequency, absorption, and the difference between noise reduction and transmission loss. Analysis shows that these factors have significant effects on noise transmission but they do not account for the differences between measured and predicted trends at low frequencies. An analytical model combining an infinite flat plate with a normally incident acoustic wave having exponentially decaying magnitude along one coordinate is used to study the effect of a localized source

distribution such as is associated with propeller noise. Results show that the localization brings the predicted low-frequency trend of noise transmission into better agreement with measured propeller results. This effect is independent of low-frequency stiffness effects that have been previously reported to be associated with boundary conditions. Author

N86-24394*# DSMA Engineering Corp., Orlando, Fla.
MODIFICATIONS TO THE 4x7 METER TUNNEL FOR ACOUSTIC RESEARCH: ENGINEERING FEASIBILITY STUDY Final Report
Mar. 1986 83 p refs
(Contract NAS1-17892)
(NASA-CR-178079; NAS 1.26:178079; Rept-4054/R128) Avail: NTIS HC A05/MF A01 CSCL 20A

The NASA-Langley Research Center 4 x 7 Meter Low Speed Wind Tunnel is currently being used for low speed aerodynamics, V/STOL aerodynamics and, to a limited extent, rotorcraft noise research. The deficiencies of this wind tunnel for both aerodynamics and aeroacoustics research have been recognized for some time. Modifications to the wind tunnel are being made to improve the test section flow quality and to update the model cart systems. A further modification of the 4 x 7 Meter Wind Tunnel to permit rotorcraft model acoustics research has been proposed. As a precursor to the design of the proposed modifications, NASA is conducted both in-house and contracted studies to define the acoustic environment within the wind tunnel and to provide recommendations or the reduction of the wind tunnel background noise to a level acceptable to acoustics researchers. One of these studies by an acoustics consultant, has produced the primary reference documents that define the wind tunnel noise sources and outline recommended solutions. Author

N86-24395# Pittsburgh Univ., Pa. Center for Multivariate Analysis.
ON DETECTION OF NUMBER OF SIGNALS IN PRESENCE OF COLORED NOISE USING INFORMATION THEORETIC CRITERIA
L. C. Zhao, P. R. Krishnaiah, and Z. D. Bai Oct. 1985 36 p
(Contracts N00014-85-K-0292; F49620-85-C-0008)
(AD-A161847; TR-85-39; AFOSR-85-1131TR) Avail: NTIS HC A03/MF A01 CSCL 09/4

Information theoretic criteria are proposed for detection of the number of signals when the noise is colored. The strong consistency of these criteria is also established. GRA

N86-24396# Naval Ocean Research and Development Activity, Bay St. Louis, Miss.
MEASUREMENT OF SOUND PROPAGATION, DOWN SLOPE TO A BOTTOM-LIMITED SOUND CHANNEL
William M. Carey, I. Gereben, B. A. Brunson, and M. R. Bradley Aug. 1985 46 p Presented at the 109th Meeting of the Acoustical Society of America, Austin, Tex., 8-12 Apr. 1985
(AD-A161855) Avail: NTIS HC A03/MF A01 CSCL 20/1

Signal transmission loss and spatial coherence data for source-receiver separations between 100 and 250 km were acquired in the Gulf of Mexico with a calibrated seismic measurement system (400 m deep), a towed projector (100 m deep) which emitted 67 and 173 Hz tones, and a moored Webb sound source at 988 m depth driven at 175 Hz. Environmental data such as the range dependent bathymetry and sound velocity profiles were measured. GRA

N86-24397# Defence Research Establishment Atlantic, Dartmouth (Nova Scotia).
A TWO-ENDED SHOOTING TECHNIQUE FOR CALCULATING NORMAL MODES IN UNDERWATER ACOUSTIC PROPAGATION
Dale D. Ellis Sep. 1985 45 p
(AD-A161965; DREA-85/105) Avail: NTIS HC A03/MF A01 CSCL 20/1

An algorithm for the calculation of acoustic normal modes in the ocean is described. The algorithm is valid for an arbitrary sound speed and density profile in the water column and bottom. Losses due to volume absorption in the water and bottom, surface and bottom roughness, and shear waves in the bottommost layer can be calculated as perturbations. The essential feature of the algorithm is a two-ended shooting method in which the trial solution is started separately at the surface and bottom and numerically integrated to a matching depth in the middle, usually near the minimum sound speed. The trial solution is iterated until a continuous function with a continuous derivative is obtained. Shooting from both ends results in a more stable algorithm and gives more accurate eigenfunctions than are obtained using conventional single-ended shooting methods. For completeness, equations are given for calculating group velocities, propagation loss in a range-dependent environment, and losses due to volume absorption, surface and bottom roughness, and shear waves in the bottommost layer. GRA

N86-24398# Naval Postgraduate School, Monterey, Calif.
PARAMETRIC ANALYSIS OF ECHOSOUNDER PERFORMANCE M.S. Thesis
Robert J. Fuller Sep. 1985 156 p
(AD-A162138) Avail: NTIS HC A08/MF A01 CSCL 20/1

An echosounder is used to probe various atmospheric parameters. An acoustic wave is transmitted into the atmosphere and information deduced from the backscattered energy. This thesis seeks to understand the range limitations of the echosounder and to explore methods to quantify atmospheric turbulence parameters at a given range. The propagation of the acoustic energy, including the effects of excess attenuation, are modeled to predict the performance of an echosounder when various parameters are changed. The electronics of an existing echosounder are investigated to understand inherent or design limitations. Author (GRA)

N86-24399# Air Force Geophysics Lab., Hanscom AFB, Mass.
VIBRO-ACOUSTIC FORECASTS FOR STS (SPACE TRANSPORTATION SYSTEM) LAUNCHES AT V23, VANDENBERG AFB: RESULTS SUMMARY AND THE PAYLOAD PREPARATION ROOM
James C. Battis 8 May 1985 85 p
(AD-A162192; AFGL-TR-85-0133; AFGL-ERP-922) Avail: NTIS HC A05/MF A01 CSCL 22/4

The launch induced vibro-acoustic environments have been forecast for several Ground Support System structures at V23, the STS launch facility at Vandenberg, AFB. These forecasts are based on site particular vibration and pressure responses determined by an explosive sounding program conducted at V23. The responses are coupled with an STS acoustic pressure term established by measurement of STS launches at KSC. This report provides a summary of the results of this effort and provides the forecasts for the vibration environment in the PPR. Motion levels in the PPR are found to be substantially below all levels of concern. However, companion studies have shown that high accelerations can be anticipated in the OFS Room and the PCR. In addition, pounding could occur between PCR and PPR. Strong reverberations on acoustic records from V23 indicate that launch overpressures at V23 will be significantly altered from those at KSC for the shuttle at altitude and clear of the ground. Finally, the potential of pounding due to earthquake ground motions is discussed. GRA

N86-24400# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AN ULTRASONIC DEVICE FOR SIGNAL PROCESSING
S. V. Kulakov, A. G. Leks, S. P. Semenov, and G. K. Ulyanov 15 Nov. 1985 6 p Transl. into ENGLISH of Russian Patent 341 121 (6 Jun. 1972) p 1-2
(AD-A162368; FTD-ID(RS)T-1610-84) Avail: NTIS HC A02/MF A01 CSCL 20/1

The invention concerns the field of analog processing of the signals of phased antenna arrays in sonar and radar. The ultrasonic signal processor announced in USSR Patent 319986 does not eliminate spurious signals. In the present device, in order to remove spurious signals, the polygon is in the form of a piezoceramic plate, at one side of which the electrodes of a retransmitting

array and the electrodes of a counting array are jointly deposited, while the edges of this side are covered with an absorber of ultrasonic surface waves. GRA

N86-24401# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AN ULTRASONIC DEVICE FOR SIGNAL PROCESSING
S. V. Kulakov, A. G. Leks, S. P. Semenov, and G. K. Ulyanov 15 Nov. 1985 6 p Transl. into ENGLISH of Russian Patent 319 986 (2 Nov. 1971) p 1-2
(AD-A162369; FTD-ID(RS)T-1567-84) Avail: NTIS HC A02/MF A01 CSCL 20/1

The invention concerns the field of radioengineering and can be used in analog processors of the signals of phased antenna arrays. There are familiar devices for processing the signals of phased antenna arrays. However these are large in size, structurally complicated, and contain expensive parts. In the proposed device, for the purpose of simplification and cheapening the design and reducing the dimensions, the counting system is in the form of a receiving acoustical array, the elements of which are hooked up to a television-type indicator. GRA

N86-24402# Naval Submarine Medical Center, Groton, Conn.
HEARING AND UNDERWATER NOISE EXPOSURE Final Report
Paul F. Smith 27 Aug. 1985 26 p
(AD-A162380; NSMRL-923) Avail: NTIS HC A03/MF A01 CSCL 06/10

Exposure of divers to intense noise in water is increasing, yet there is no general hearing conservation standard for such exposures. This paper reviews three theories of underwater hearing as well as empirical data in order to identify some requirements that an underwater conservation standard must meet. Among the problems considered are hearing sensitivity in water, the frequency and dynamic ranges of the water-immersed ear, and nonauditory effects of underwater sound. It is concluded that: first, no well developed theoretical basis exists for extrapolating hearing conservation standards for airborne noise to the underwater situation; second, the empirical data on underwater hearing suggest that the frequency range covered by an underwater hearing conservation standard must be broader than is the case in air; third, in order to establish a general hearing conservation standard for underwater noise exposure further research is required on the dynamic range of the ear in water; fourth, underwater noise exposure may involve hazards to other body systems than the ear; and fifth, some exposure conditions may interfere with job performance of divers. GRA

N86-24403# Weston Observatory, Mass.
ACOUSTIC FORECAST FOR SHUTTLE LAUNCHES AT VANDENBERG AFB
Francis A. Crowley 13 Nov. 1985 6 p Presented at the AIAA Shuttle Environment and Operations 2 Meeting, Houston, Tex., 13-15 Nov. 1985 Previously announced in IAA as A86-14397
(Contract F19628-84-C-0011)
(AD-A162862; AFGL-TR-85-0335; SR-3) Avail: NTIS HC A02/MF A01 CSCL 20/1

Acoustic loads on ground support structures for Shuttle launches at Vandenberg AFB are forecast in a way that satisfies local reverberations. Acoustic spectra at points neighboring the Vandenberg Launch Mount are expected to be enhanced by as much as 15 db by site specific acoustics. Simulated launch loads on the east face of the Payload Preparation Room have a maximum overall sound power level of 156 db. The corresponding sound power maximum for the same averaging time, bandwidth and distance at Kennedy Space Center over a path free of reverberations and ground water cloud attenuation is 149 db. The peak pressure on the Payload Preparation Room after 10 launches is predicted to be 165 db. After a lifetime of 100 launches, peak pressure on the facility is expected to reach 167 db. GRA

N86-24404# Florida Inst. of Tech., Melbourne.
FERROFLUID HYDROACOUSTIC PROJECTOR Final Report, Sep. 1980 - Dec. 1983
Mark S. Ptak and Pieter S. Dubbelday 30 Nov. 1985 57 p
(Contract N00014-80-C-0932)
(AD-A163077; NRL-MR-5644) Avail: NTIS HC A04/MF A01 CSCL 20/1

A hydroacoustic projector has been constructed with a ferrofluid as the magneto-acoustic transduction material. It has a toroidal shape; a dc magnetic bias field magnetizes the particles, and an ac field causes bulk movement of the fluid inside the toroid, as contrasted with magnetostriction. The construction of a prototype projector is described. As predicted by theory, the frequency of the acoustic field without bias field is predominantly double that of the exciting frequency; with bias field the single frequency appears in the acoustic measurements. The experimental results show strong resonances from 10 to 100 Hz. They are tentatively ascribed to flexural resonances in the walls of the tank. Further experiments are needed to definitely rule out other sources of sound not originating in the ferrofluid. GRA

N86-24405# Southampton Univ. (England). Inst. of Sound and Vibration Research.
ACOUSTICALLY COMPACT TRANSIENT SOURCES FOR UNDERWATER MEASUREMENT AND CALIBRATION
J. Nedwell Apr. 1985 42 p ref Sponsored by UK Ministry of Defence Procurement Executive
(ISVR-TR-129) Avail: NTIS HC A03/MF A01

Explosives, rupture diaphragms, exploding bridgewires, hydrophones, and underwater sparks were assessed to develop an acoustically compact source for underwater calibration and measurement. Explosive sources display variations in pressure waveform and are thus not generally suitable for calibration. Rupture diaphragms are not a suitable acoustically compact source for generating transients. Exploding bridgewires are safe, reliable, and repeatable but are best suited to one-off calibration purposes due to the long reloading time. Hydrophones are highly repetitive and stable sources, but suffer from a tendency to oscillation, and produce low acoustic power. Underwater sparks are inherently dangerous due to the high voltages required and emit powerful interference. They are reliable and rapidly repeatable, stable in waveform, but suffer from variations in amplitude. If scaling can be performed, the use of a reference hydrophone may reduce the effect of variations in amplitude. Careful electrode design is required to retain the circular symmetry of the acoustic field.
Author (ESA)

N86-24406# United Kingdom Atomic Energy Authority, Harwell (England). Materials Physics and Metallurgy Div.
CHARACTERIZATION OF MICROSTRUCTURES USING ULTRASONICS: A COMPARISON OF THEORY AND EXPERIMENT
C. M. Sayers and R. L. Smith Jul. 1985 10 p refs
(AERE-R-11589) Copyright. Avail: Issuing Activity

The scattering of ultrasound in polycrystalline and two phase materials is discussed. Scattering theory is in good agreement with experiment for discrete inclusions. For a second phase formed by segregation at a grain boundary, the scattering by a spherical shell is considered. This should be applicable to Fe-C alloys, but analysis of the data shows the changes in attenuation to be accounted for by absorption rather than by differences in scattering. This is consistent with the small thickness of the cementite layer.
Author

N86-24407# United Kingdom Atomic Energy Authority, Harwell (England). Materials Physics and Metallurgy Div.
TEXTURE AND STRESS DETERMINATION IN METALS USING ULTRASONIC RAYLEIGH WAVES AND NEUTRON DIFFRACTION
C. M. Sayers, D. R. Allen, G. E. Haines, and G. G. Proudfoot Jul. 1985 31 p refs
(AERE-R-11860) Copyright. Avail: Issuing Activity

Polycrystalline metals often contain significant levels of texture and internal stress. Plastic anisotropy originates from the texture, or crystallographic alignment, and can affect the formability of the metal, whereas the presence of internal stress can seriously limit

the lifetime of a component. In the presence of either texture or stress, the ultrasonic velocity in the material depends on the propagation and polarization directions, and there is considerable interest in exploiting this anisotropy for nondestructive texture and stress determination. An analytical expression for the angular dependence of the Rayleigh wave velocity in polycrystalline metals with small anisotropy typical of rolled plate is given. Surface wave velocity measurements can be combined with the normal shear wave birefringence technique to give a texture independent determination of the difference in principal stresses in the plane of the plate. The theory is tested by comparing ultrasonic measurements on two aluminum plates with the behavior predicted using a neutron diffraction determination of the crystallite orientation distribution function. Author

N86-24408# United Kingdom Atomic Energy Authority, Harwell (England). Theoretical Physics Div.
HARWELL COMPUTER MODELS FOR ULTRASONIC NDT
J. A. Ogilvy and J. A. G. Temple Jun. 1985 66 p refs
(AERE-R-11830) Copyright. Avail: Issuing Activity

A suite of 8 computer programs, created and installed on the Harwell central computer, for modelling various aspects of ultrasonic nondestructive testing are described. The report is not a comprehensive user's guide to the programs since mathematical details of the models are not included. It aims to given an idea of the score of each computer code and improvements which are likely to be made. Details of all the input parameters to the computer codes and examples of job control language for the Harwell machines are given. This should be sufficient information to enable anyone who is interested to try out the codes for their own problems. It is hoped that the codes are of sufficiently wide interest and applicability to be used outside the Atomic Energy Authority (UKAEA). Author

N86-24409# United Kingdom Atomic Energy Authority, Harwell (England). Theoretical Physics Div.
ULTRASONIC WAVE SCATTERING FROM ROUGH DEFECTS: THE ELASTIC KIRCHHOFF APPROXIMATION
J. A. Ogilvy Jun. 1985 80 p refs
(AERE-R-11866) Copyright. Avail: Issuing Activity

The effect of surface roughness on ultrasonic wave scattering from defects is examined theoretically. Far field expressions for the scattered displacement amplitudes are found for both the direct and mode converted signals. Elastic Green's Theorem was used to obtain an explicit representation for the scattered displacements in terms of the unknown displacements and stresses on the defect surfaces when an infinite plane wave is incident. Elastic Kirchhoff theory is used to approximate these unknown fields and the resulting surface integral is evaluated in the far field. The resulting expressions, valid for defects of arbitrary shape, are specialized for the case of a rectangular defect whose surfaces have statistically described roughness. The reflected amplitude is decreased due to the presence of roughness. A greater decrease is noted for scattering involving shear (SV) waves than for compression waves. These effects were quantified and changes in frequency or surface roughness effect the scattering amplitudes were determined. Author

N86-24359# Joint Publications Research Service, Arlington, Va.
AMPLIFICATION OF ACOUSTIC PERTURBATIONS DURING REFLECTION FROM CRITICAL LAYER IN SUPERSONIC FLOWS Abstract Only
P. I. Kolykhalov *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-004) 7 Feb. 1986 p 1 Transl. into ENGLISH from Doklady Akademii Nauk SSSR (Moscow, USSR), v. 280, no. 1, Jan. 1985 p 95-98 Original language document was announced in IAA as A85-24181 (For primary document see N86-24358 14-70)
Avail: NTIS HC A06

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N86-24410# Northwestern Univ., Evanston, Ill. Dept. of Chemistry.
PARTICLE DISTRIBUTIONS AND LASER-PARTICLE INTERACTIONS IN AN RF DISCHARGE OF SILANE Interim Report
Kenneth G. Spears, Timothy J. Robinson, and Richard M. Roth 20 Nov. 1985 18 p
(Contract N00014-79-C-0622)
(AD-A161922; TR-9) Avail: NTIS HC A02/MF A01 CSCL 20/9

A capacitively coupled, RF discharge of silane in argon was studied to determine particle distributions by light scattering and particle photophysics. Ultraviolet lasers cause silicon atom formation in both ground and excited states. Atoms were not formed with 354 or 532 nm excitation, but the discharge chemistry was affected by 354 nm excitation. GRA

N86-24411# George Washington Univ., Washington, D.C. Dept. of Chemistry.
THE AUGER LINESHAPE OF GRAPHITE
J. W. Rogers, J. E. Houston, R. R. Rye, R. L. Hutson, and D. E. Ramaker Oct. 1985 6 p
(Contract N00014-80-K-0852; DA Proj. PP0-1308)
(AD-A161959; TR-19) Avail: NTIS HC A02/MF A01 CSCL 07/4

The C KVV Auger lineshape of graphite is quantitatively interpreted. Localization, static and dynamic screening effects, and intrinsic plasmon loss effects are discussed in the context of the theoretical model and found to contribute significantly to the lineshape. Author (GRA)

N86-24412# George Washington Univ., Washington, D.C. Dept. of Chemistry.
AN INTERPRETATION OF THE O2 AUGER ELECTRON SPECTRUM
Hideo Sambe and David E. Ramaker Oct. 1985 23 p
(Contract N00014-80-K-0852; PP0-1308)
(AD-A161960; TR-20) Avail: NTIS HC A02/MF A01 CSCL 07/4

The Auger electron spectrum of O2 is interpreted by comparing with other spectra, such as photoelectron spectrum, the electron impact mass spectrum, and the double charge transfer spectrum. Each of these four spectra obeys their own selection rules; the difference in the selection rules plays a key role in our interpretation. Auger decays following a core shake-up excitation are identified for the first time. Many of the previous assignments are revised. GRA

N86-24413# General Electric Co., Schenectady, N. Y.
DETERMINATION OF ELECTRONIC AND ATOMIC STRUCTURAL PARAMETERS DURING FAST ION TRANSPORT Final Report, 1 Jul. 1983 - 30 Nov. 1985
F. W. Lytl and T. R. Beck Nov. 1985 21 p Prepared in cooperation with Boeing Co., Seattle, Wash.
(Contract N00014-83-C-0620)
(AD-A161977; FR-4) Avail: NTIS HC A02/MF A01 CSCL 07/4

X-ray absorption spectroscopy was used to determine the valence state and local structure in a vanadium bronze and a tungsten bronze series of fast ion conducting materials. The structure parameters confirm previous X-ray diffraction results; however, the direct determination of valence state(s) is a unique result. X-ray methods appear to offer real advantages for in situ characterization. X-ray absorption spectroscopy is able to single out each different kind of element in a complex material because the core-level absorption edges are well separated in energy. The region near the absorption edge, X-ray absorption near edge structure (XANES) contains information on the valence state and local symmetry of the absorbing atom. The etended X-ray absorption fine structure (EXAFS) above the absorption edge is caused by scattering of the ejected photoelectron and may be used to determine near neighbor structural parameters. GRA

N86-24414# George Washington Univ., Washington, D.C. Dept. of Chemistry.
THE RELATIONSHIP BETWEEN THE AUGER LINESHAPE AND THE ELECTRONIC PROPERTIES OF GRAPHITE
J. E. Houston, J. W. Rogers, R. R. Rye, F. L. Hutson, and David E. Ramaker Oct. 1985 28 p Prepared in cooperation with Sandia National Labs., Albuquerque, N. Mex.
(Contracts N00014-80-K-0852; DE-AC04-76DP-00789; PP0-1308) (AD-A162042; TR-24) Avail: NTIS HC A03/MF A01 CSCL 07/4

The experimental carbon Auger lineshape corrected for the effects of the secondary-electron background and extrinsic losses and placed on an absolute energy scale through the use of photoelectron measurements. The resulting lineshape is compared to a model which consists of the self-convolution of the graphite one-electron density of states, including atomic values for the symmetry determined Auger matrix elements. A poor comparison results from this simple model which is considerably improved by the inclusion of dynamic initial-state screening effects. Further improvements results from accounting for final-state hole-hole interactions. The final state is characterized by effective hole-hole interaction energies of 2.2 eV, corresponding to two holes in the sigma band, 1.5 eV for one hole in the sigma and one in the pi band, and 0.6 eV for both holes in the pi band. The remaining discrepancies in our model comparison are suggested to be due to a plasmon emission intrinsically coupled to the Auger final state. GRA

N86-24415# George Washington Univ., Washington, D.C. Dept. of Chemistry.
MECHANISMS FOR EXCITED NEUTRALS AND NEGATIVE AND POSITIVE ION DESORPTION FROM SURFACES
David E. Ramaker Oct. 1985 12 p
(Contract N00014-80-K-0852; PP0-1308)
(AD-A162043; TR-18) Avail: NTIS HC A02/MF A01 CSCL 07/5

In this review we summarize and generalize the results of a recent detailed comparative investigation of OH*, OH+, and H+ desorption from OH/TiO2, H2O(s), and H2O(g), and O- and O+ desorption from O/W and O/Mo(10). Two mechanisms for O- and OH* desorption have been proposed which were not revealed in the positive ion desorption yields. These additional electron attachment mechanisms are placed in the context of the previously proposed ionic desorption mechanisms and are discussed in detail. GRA

N86-24416# George Washington Univ., Washington, D.C. Dept. of Chemisty.
A CONSISTENT QUANTITATIVE INTERPRETATION OF THE AUGER LINESHAPES OF CARBON IN MOLECULES AND SOLIDS
David E. Ramaker and F. L. Hutson Oct. 1985 7 p
(Contract N00014-80-K-0852; PP0-1308)
(AD-A162044; TR-25) Avail: NTIS HC A02/MF A01 CSCL 07/4

In this work we have theoretically interpreted the C KVV Auger lineshapes for benzene and cyclohexane in a procedure consistent with that used previously for graphite and diamond. The one-electron density of states are obtained empirically and localization effects are included within the Cini-Sawatzky model. The empirically determined final state hole-hole repulsions are seen to be very similar to those obtained for the corresponding solids. GRA

N86-24417# George Washington Univ., Washington, D.C. Dept. of Chemistry.
DESORPTION OF EXCITED NEUTRALS FROM SURFACES VIA AN ELECTRON ATTACHMENT MECHANISM
David E. Ramaker Oct. 1985 14 p
(Contract N00014-80-K-0852; PP0-1308)
(AD-A162045; TR-23) Avail: NTIS HC A02/MF A01 CSCL 07/5

A detailed comparative investigation of OH and OH+ desorption from OH/TiO2, H2O(s), and H2O(g) indicates four different mechanisms are responsible for the OH desorption. Two of these involve a resonant excitation-dissociative attachment-mechanism. The other two mechanisms involve non-resonant excitation or ionization processes similar to that responsible for the OH+ desorption. GRA

N86-24418# George Washington Univ., Washington, D.C. Dept. of Chemistry.
DYNAMIC CORE-HOLE SCREENING EFFECTS IN THE C(KVV) AUGER LINESHAPE OF GRAPHITE
J. E. Houston, David E. Ramaker, J. W. Rogers, R. R. Rye, and F. L. Hutson Oct. 1985 8 p
(Contract N00014-80-K-0852; PP0-1308)
(AD-A162046; TR-22) Avail: NTIS HC A02/MF A01 CSCL 07/4

Evidence is presented for the presence of a shakedown satellite near threshold in the C(KVV) Auger spectrum of graphite. Its origin is shown to be an electron in a relatively long-lived valence/core excitonic level (populated as a result of dynamic core-hole screening) which participates in the Auger decay. Modeling the shakedown contribution considerably improves agreement in the threshold region between the experimental lineshape and a simple one-electron model. GRA

N86-24419# Physical Sciences, Inc., Andover, Mass.
KINETICS OF IODINE MONOFLUORIDE EXCITATION BY ENERGETIC NITROGEN Final Report, 16 Jun. 1983 - 16 Aug. 1984
Laurence G. Piper, W. J. Marinelli, B. D. Green, W. T. Rawlins, and H. C. Murphy Oct. 1985 112 p
(Contract F29601-83-C-0051)
(AD-A162085; PSI-051/TR-460; AFWL-TR-84-156) Avail: NTIS HC A06/MF A01 CSCL 07/4

We studied the production and loss of IF (Iodine MonoFluoride) in our flow system using a laser-induced fluorescence diagnostic for measuring IF number densities. We related the production of F-atoms to the residence time of CF4 in the microwave discharge and found a yield of about 0.3 F-atoms per CF4 molecule under typical operating conditions. We identified flow conditions that produce complete reaction of CF3I in the injector and showed that a negligible amount of IF is destroyed in the injector under these conditions. Some loss of IF in the main flow tube was found at low flow velocities; however, this loss appeared to be negligible at higher velocities and permitted us to operate in a regime where IF number densities were directly related to the amount of CF3I flowing into the injector. We also found that operation of the injector using excess CF3I resulted in the deposition of an optically opaque thin film on the reactor walls. This required us to operate in excess F-atoms and eliminated the need to measure absolute F-atom number densities. GRA

N86-24420# George Washington Univ., Washington, D.C. Dept. of Chemistry.
AN INTERPRETATION OF THE N2 PHOTOELECTRON SPECTRUM
Hideo Sambe and David E. Ramaker Oct. 1985 12 p
(Contract N00014-80-K-0852)
(AD-A162103; TR-21) Avail: NTIS HC A02/MF A01 CSCL 07/4

The inner-valence (20-36eV) photoelectron spectrum of N2 is interpreted by comparing with various spectra (such as absorption, N(+) yield, fluorescence-yield, and core-level photoelectron spectra) and with previously published theoretcal calculations. This empirical interpretation allows for unique assignments, and enables us to distinguish between the four previously published theoretical calculations which lead to inconsistent assignments. GRA

N86-24421# State Univ. of New York, Buffalo. Dept. of Chemistry.
THERMALIZATION IN MULTIPHOTON EXCITATION OF MOLECULES Interim Technical Report
Xi-Yi Huang and Thomas F. George Nov. 1985 13 p
(Contract N00014-80-C-0472)

(AD-A162113; UBUFFALO/DC/85/TR-71) Avail: NTIS HC A02/MF A01 CSCL 07/4

The thermalization of coherent multiphoton excitation of molecules is examined. An inspection of the level distribution of a driven anharmonic oscillator, which is subject to energy and phase dissipation to a bath, reveals that phase relaxation (dephasing) due to the bath perturbation plays a major role in the thermalization process. GRA

N86-24422# Lowell Univ., Mass. Center for Atmospheric Research.

MICROWAVE AND INFRARED ABSORPTION PROPERTIES OF ATMOSPHERIC SPECIES WITH SPECIAL EMPHASIS ON LINE WIDTHS AND SHIFTS Final Report, 29 Apr. 1982 - 29 Jul. 1985

Robert R. Gamache Jul. 1985 125 p

(Contract F19628-82-K-0043)

(AD-A162154; ULRF-428/CAR; AFGL-TR-85-0168) Avail: NTIS HC A06/MF A01 CSCL 07/4

In this report the work performed on updating the HITRAN data base and hot gas atlas is described and the list of data given. Our work on the development of the QFT-ID theory for collision broadened halfwidths of asymmetric rotors, i.e. 03 and H20, is described. A review of second order perturbation schemes to calculate the line shift and width is given with application to H20. The temperature dependence of the line shift and halfwidth is formulated and results are presented for the 03-N2 and 03-02 systems. GRA

N86-24423# Wisconsin Univ., Madison. Dept. of Physics.

INFRARED EMISSION AND ATOMIC TRANSITIONS Annual Technical Report, 1 Aug. 1984 - 31 Jul. 1985

Chun C. Lin 5 Aug. 1985 3 p

(Grant AF-AFOSR-0312-83)

(AD-A162245; AFOSR-85-1101TR) Avail: NTIS HC A02/MF A01 CSCL 07/4

The general objective of this research project is to study radiative transitions in atoms and molecules especially those relevant to infrared radiation. Major efforts include: (1) determination of optical emission cross sections for atomic oxygen transitions produced by electron-impact dissociation of O2, (2) electron excitation from a metastable level to a higher level, (3) excitation behaviors of Na atoms, and (4) production of excited N atoms b electron impact on N2. GRA

N86-24424# State Univ. of New York, Buffalo. Dept. of Chemistry.

VIBRATIONAL DEPHASING AND ENERGY RELAXATION OF ADMOLECULES BY PHONONS

Michael Hutchinson and Thomas F. George Dec. 1985 18 p

(Contract N00014-86-K-0043)

(AD-A162315; UBUFFALO/DC/85-TR-2) Avail: NTIS HC A02/MF A01 CSCL 07/4

An investigation is made of the vibrational dephasing of a diatomic molecule absorbed on a surface. Explicit analytic forms for the rate of dephasing by phonons are derived. For comparison, an expression for energy relaxation is given which is appropriate for OH on SiO2. It is found that the dephasing rate is considerably faster for this system than the energy relaxation rate. These conclusions are compared with the results of a recent experiment. GRA

N86-24425# Florida Univ., Gainesville. Dept. of Chemistry.

ATOMIC AND MOLECULAR GAS PHASE SPECTROMETRY Summary Report, 1 Oct. 1983 - 30 Sep. 1985

J. D. Winefordner Oct. 1985 40 p

(Contract F49620-84-C-0002)

(AD-A162339; AFOSR-85-1034TR) Avail: NTIS HC A03/MF A01 CSCL 21/2

The major goals of this research have been to develop diagnostical spectroscopic methods for measuring spatial/temporal temperatures and species of combustion flames and plasmas and to develop sensitive, selective, precise, reliable, rapid spectrometric methods of trace analysis of elements present in jet engine lubricating oils, metallurgical samples, and engine exhausts. The diagnostical approaches have been based upon the measurement of metal probes introduced into the flame or plasmas and the measurement of OH in flames. The measurement approaches have involved the use of laser-excited fluorescence, saturated absorption, polarization, and linear absorption. The spatial resolution in most studies is less than 1 cu mm and the temporal resolution is less than 10 ns with the use of pulsed lasers. Single pulse temperature and species measurements have also been carried out. Other diagnostical studies have involved the measurement of collisional redistribution of radiatively excited levels of Na and Tl in acetylene/02/Ar flames and the measurement of lifetimes and quantum efficiencies of atoms and ions in the inductively coupled plasmas, ICP. The latter studies indicate that the high electron number densities in ICPs are not efficient quenchers of excited atoms/ions. Temperatures of microwave atmospheric plasmas produced capacitatively and cool metastable N2 discharge produced by a dielectric discharge have also been measured. GRA

N86-24426# Naval Research Lab., Washington, D. C.

A COMPARISON OF QUANTUM, CLASSICAL, AND SEMICLASSICAL DESCRIPTIONS OF A MODEL, COLLINEAR, INELASTIC COLLISION OF TWO DIATOMIC MOLECULES

M. Page, E. S. Oran, J. P. Boris, D. Miller, and R. E. Wyatt 13 Dec. 1985 47 p

(AD-A162357; NRL-MR-5700) Avail: NTIS HC A03/MF A01 CSCL 20/8

The collinear dynamics of a model diatom-diatom system is investigated. The collision partners are harmonic oscillators for which the masses and force constants are chosen to correspond to those of the nitrogen and oxygen molecules. The interaction between the molecules arises from a Lennard-Jones 6-12 potential acting between the inside atoms in the collinear system. Quantum mechanical close coupled calculations are performed for several collision energies ranging from 1.0 ev to 2.25 ev. The state-to-state transition probabilities which are extracted from these calculations are then used as a benchmark for comparison. Semiclassical calculations are performed within the framework of a classical path approximation. A simple scheme to modify the classical path to reflect energy exchange between the collision coordinate and the internal degrees of freedom is found to improve the results. On the whole, the agreement between the semiclassical and the quantum mechanical results is surprisingly good. The classical trajectory calculations correctly display many of the qualitative features of the collisions but the numerical agreement is not as close. Unexpectedly, the classical results do not appear to be improving as the collision energy is increased. GRA

N86-24427# Argonne National Lab., Ill.

AB INITIO MOLECULAR ORBITAL CALCULATIONS OF THE VIBRATIONAL FREQUENCIES OF XY4/SUP -n/ ANIONS

L. A. Curtiss and R. Nichols 1985 8 p refs Presented at the 5th International Symposium on Molten Salts, Las Vegas, Nev., 14 Oct. 1985

(Contract W-31-109-eng-38)

(DE86-001817; CONF-8510177-2) Avail: NTIS HC A02/MF A01

The vibrational frequencies of a seris of XY4/sup -n/ anions (BeF4(-2), BF4(-), AlF4(-), MgCl4(-2), and AlCl4(-)) have been calculated by ab initio molecular orbital theory using the 3-21G and 6-31G* basis sets. The predicted harmonic frequencies are for the most part in good agreement with the observed frequencies of these anions in molten alkali halide mixtures. At the 3-21G basis set level the average difference between the observed and predicted frequencies is 12% while at the 6-31G* basis set level the average difference is 6%. Calculations of this type may be helpful in predicting the vibrational frequencies of other anions in molten salts. DOE

N86-24428# Oak Ridge National Lab., Tenn.

DIELECTRONIC RECOMBINATION MEASUREMENTS ON MULTICHARGED IONS

P. F. Dittner, S. Datz, P. D. Miller, and P. L. Pepmiller 1985 11 p refs Presented at the Workshop on Atomic Spectra and Collisions in External Fields, Gaithersburg, Md., 22 Oct. 1984
(Contract DE-AC05-84OR-21400)
(DE86-002255; CONF-8410237-4) Avail: NTIS HC A02/MF A01

Coaxial electron beams and multiply charged ion beams are used to study dielectronic recombination. The study includes recombination of boron, carbon and sulfur. DOE

N86-24429# Los Alamos National Lab., N. Mex.
APPLICATIONS OF CROSS SECTIONS FOR ELECTRON-MOLECULE COLLISION PROCESSES
D. C. Cartwright 1985 9 p refs Presented at the Joint Symposium on Swarm Studies and Inelastic Electron-molecule Collisions, Tahoe, Calif., 19 Jul. 1985
(Contract W-7405-eng-36)
(DE86-002389; LA-UR-85-3519; CONF-850776-2) Avail: NTIS HC A02/MF A01

The role of electron-molecule collision cross sections is discussed for the study of the ionospheric and auroral processes in planetary atmospheres and of discharge-pumped lasers. These two areas emphasize the importance of further theoretical and experimental studies concerning electron-impact processes. DOE

N86-24430# GA Technologies, Inc., San Diego, Calif.
ENERGY CONFINEMENT IN DOUBLET 3
T. Ohkawa and R. D. Stambaugh 1985 18 p Presented at the 12th European Conference on Controlled Fusion and Plasma Physics, Budapest, Hungary, 2 Sep. 1985
(Contract DE-AC03-84ER-51044)
(DE86-002492; GA-A-18189; CONF-850927-9) Avail: NTIS HC A02/MF A01

Studies of ion confinement in Doublet 3 show that the ion thermal diffusivity chi sub i exceeds the neoclassical value by a factor of two to four at r = 0.2a increasing to a factor of ten at r = 0.7a. It appears that chi sub e and chi sub i are always closely equal, suggesting turbulence underlies the diffusion. Scaling data for energy confinement time dependence on heating power, density, current, and toroidal field are reviewed to constrain the formulation of a transport model base on turbulence. A model based on trapped electron turbulence is proposed which produces the correct scaling behavior of tau sub E in both low and high collisionality regimes. DOE

N86-24431# Lawrence Livermore National Lab., Calif.
OPTIMUM RANGES FOR X-RAY THICKNESS MEASUREMENTS
R. W. Ryon 15 Oct. 1985 26 p
(Contract W-7405-eng-48)
(DE86-003186; UCID-20581) Avail: NTIS HC A03/MF A01

Film thicknesses can be measured by two X-ray methods: X-ray absorption (gauging or radiography) and X-ray fluorescence. Optimization of both methods is discussed. DOE

N86-24432# Los Alamos National Lab., N. Mex.
ION BEAM CHARACTERIZATION OF MULTI-LAYER DIELECTRIC REFLECTORS
J. G. Beery, M. G. Hollander, C. J. Maggiore, A. Redondo, R. T. Westervelt, and T. N. Taylor 1985 8 p Presented at the 17th Annual Symposium on Optical Materials for High-power Lasers, Boulder, Colo., 28 Oct. 1985
(Contract W-7405-eng-36)
(DE86-003689; LA-UR-85-3785; CONF-851052-1) Avail: NTIS HC A02/MF A01

Energetic ion beams were used to characterize multilayer dielectric reflectors. Alpha-particle beams with beam spot sizes between 10 microns and a few millimeters were scattered from reflectors consisting of 32-layer SiO2/HfO2 and 38-layer MgF2/ThF4. The RBS spectra reveal the nature of the laser damage processes by providing information on diffusion, mixing, and loss of material in the coatings. The particle-induced X-ray emission (PIXE) technique gave complimentary results on low-concentration impurities in the coatings. DOE

N86-24433# Argonne National Lab., Ill.
RECENT PROGRESS IN POSITRON ANNIHILATION RESEARCH AT ARGONNE NATIONAL LABORATORY
L. C. Smedskjaer and R. W. Siegel Sep. 1985 8 p Presented at the Murr Slow Positron Beam Workshop, Columbia, Mo., 1 Oct. 1985
(Contract W-31-109-eng-38)
(DE86-003046; CONF-8510220-1) Avail: NTIS HC A02/MF A01

The present work describes the most recent research activity in the positron group at Argonne. Our efforts have been centered around bringing our 2-D ACRR system on line, and a short description of its properties are given here. In addition, recent positron measurements on boron doped Ni3Al, done in collaboration with A. DasGupta from the Metals and Ceramics Division, Oak Ridge National Laboratory, will be presented as well. DOE

N86-24434# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
INTEGRAL SCATTERING CROSS SECTIONS OF HIGHLY VIBRATION-EXCITED Li2 MOLECULES Thesis [INTEGRALE STREUQUERSCHNITTE HOCH SCHWINGUNGSANGEREGTER Li2-MOLEKUELE]
M. Fuchs May 1985 186 p refs In GERMAN
(MPIS-8/1985; ISSN-0436-1199) Avail: NTIS HC A09/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 38

The Franck-Condon method to prepare vibration-excited molecular states was applied in a molecular beam experiment in order to determine integral scattering cross sections of the system Li2-noble gas atom. The experimental setup, the measuring method, and the spectroscopic fundamentals of the excitation process are described. Model calculations show good agreement with the experimentally determined integral cross sections. Author (ESA)

N86-24435# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
MOLECULAR BEAM EXPERIMENT OF THE REACTIVE SCATTERING D+H2 YIELDS HD+H Thesis [MOLEKULARSTRAHLEXPERIMENT DER REAKTIVEN STREUUNG D+H2 YIELDS HD+H]
R. Goetting May 1985 161 p refs Sponsored by Gesellschaft fuer Wissenschaftliche Datenverabeitung, Goettingen, West Germany
(MPIS-13/1985; ISSN-0436-1199) Avail: NTIS HC A08/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 33

The reaction D+H2 yields HD+H was investigated in a molecular beam at a translational energy > 1.0 eV, scanning the potential hypersurfaces in the same energy domain as the reaction of vibration-excited hydrogen molecules. Angular and product velocity distributions of the reactions were determined. The differential scattering cross section at high collision energies is found to be strongly broadened compared with calculations and experiments at lower energies. The measured angular and time-of-flight distributions can satisfactorily be fitted with quasiclassical trajectory data calculated on potential hypersurfaces. The HD angular distribution is described with a model calculation. This calculation describes a narrower product velocity distribution (angle independent) in contrast with a more accurate theory.
Author (ESA)

N86-24379# Joint Publications Research Service, Arlington, Va.
ROTATIONAL-VIBRATIONAL RESONANCES IN ELECTRON TRANSITION SPECTRA OF XeCl MOLECULES Abstract Only
N. G. Basov, I. S. Gorban, V. A. Danilychyev, N. C. Zubrilin, and M. G. Chernomorets *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-004) 7 Feb. 1986 p 42 Transl. into ENGLISH from Doklady Akademii Nauk SSSR (Moscow, USSR), v. 281, no. 1, Mar. 1985 p 64-66 (For primary document see N86-24358 14-70)
Avail: NTIS HC A06

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation.*

N86-24436 Cornell Univ., Ithaca, N.Y.
TOPICS IN PARTICLE PHYSICS PHENOMENOLOGY Ph.D. Thesis
James Thomas Pantaleone 1985 163 p
Avail: Univ. Microfilms Order No. DA8516898

Heavy quark physics, spine dependent forces in heavy quark systems, bound state effects in the Upsilon yields gamma + resonance, compatibility of free fractional charge, and Dirac magnetic monopoles are discussed. Using the results of the fourth-order quark-antiquark interactions in perturbative quantum chromodynamics (QCD), the spin dependent potentials in the formalism of Eichten and Feinberg and Gromes have to be generalized to include the quark mass dependence. The recently observed hyperfine and fine structure splittings in the J/Psi and Tau systems are found to agree with the purely perturbative QCD results for the scale parameter. The effect of particle-antiparticle bound state dynamics on the reaction Upsilon yields gamma + resonance were studied. The existence of a free fractionally charged particle together with a monopole that has magnetic charge g = 1/2 e poses an apparent conflict. This conflict may be resolved by enlarging the exact gauge symmetry. The resulting constraint on GUTs is discussed and illustrated with an SU(9) GUT. Under certain assumptions, SU(9) is the smallest group to satisfy the constraints. Dissert. Abstr.

N86-24437 Virginia Polytechnic Inst. and State Univ., Blacksburg.
STUDIES OF LEPTON AND QUARK INTERACTIONS Ph.D. Thesis
Ping Wang 1985 119 p
Avail: Univ. Microfilms Order No. DA8521367

All possible experiments which test the SU(2) sub L x U(1) sub R x U(1) sub sub B-L model and SU(2) sub R x U(1) sub B-L model using the LEP e-e collider and HERA e-p collider are calculated and the most sensitive experiments are examined. (Q antiq) and (Q antiq) mesons are calculated using a QCD motivated potential model. It is discovered that by including a long distance relativistic correction term derived by Grome, the Coulomb + Linear potential works not only for c and b quarks, but s quark as well. The leptonic decay constants of various (Q antiq) mesons together with their masses are predicted. The topponium states are also discussed. Dissert. Abstr.

N86-24438# Naval Research Lab., Washington, D. C.
EFFECT OF FINITE CURRENT CHANNEL WIDTH ON THE COLLISIONAL ION CYCLOTRON INSTABILITY
J. D. Huba and P. K. Chaturvedi 21 Nov. 1985 28 p
(AD-A162070; NRL-MR-5683) Avail: NTIS HC A03/MF A01 CSCL 04/1

The effect of a finite transverse width, magnetic field-aligned current on the collisional ion cyclotron instability is studied. It is found that a finite current width has a stabilizing influence on the instability. The results are discussed in the context of auroral ionosphere. The field-aligned currents in the auroral ionosphere are an integral part of the ionosphere-magnetosphere coupling system and it is fairly well established now that these currents can be highly nonuniform in structure. Often, the current system is in the form of sheets which have variable thicknesses. An attempt to study the effect of finite width of a current sheet on the current driven collisionless ion acoustic instability was made with applications to the auroral situation. This paper investigated the effects of a finite width current channel on the collisional ion cyclotron (CICI) instability. The instability can also be stabilized for sufficiently narrow current channels. GRA

N86-24439# Michigan Univ., Ann Arbor. Dept. of Nuclear Engineering.
NEUTRAL BEAM INTERACTIONS WITH MATERIALS Final Report, 1 Jun. 1984 - 31 Oct. 1985
R. M. Gilgenbach, J. J. Duderstadt, and R. S. Ong 22 Nov. 1985 104 p
(Grant AF-AFOSR-0130-84)
(AD-A162330) Avail: NTIS HC A06/MF A01 CSCL 20/9

The basic approach involves coupling a one-dimensional hydrodynamic code to an ionization dynamics and an energy deposition model. Radiation emitted by the plasma is an important diagnostic tool. The ionization dynamics is very carefully accomplished by developing an ionization dynamics model which considers a large number of excited states and atomic processes. The atomic processes which are considered in our model are: (1) collisional ionization; (2) three body recombination; (3) collisional excitation; (4) collisional de-excitation; (5) spontaneous emission; (6) radiative recombination; and (7) dielectric recombination. A model to calculate the stopping power for energetic, structured (those carrying electrons into the target) low Z ions has been developed. Low Z ions are both energetic and structured at typical specific energies of a few hundred keV/amu (e.g., 1 MeV helium). The atomic structure is taken into account by describing the electron cloud of the projectile with elastic form factors in the first Born approximation. However, at these energies the first Born approximation begins to break down. Hence, two corrections are included: the Bloch correction to account for the scattering of wave packets (instead of plane waves) for close collisions, and the Barkas effect which corrects for deviations from pure Rutherford scattering due to the displacement of an oscillating electron. Structure is introduced more approximately in these two terms. An attempt has been made to allow sufficient generality to describe ionized targets as well as neutral solids. GRA

N86-24440# Los Alamos National Lab., N. Mex.
IFR CODE FOR SECONDARY PARTICLE DYNAMICS
M. R. Teague and S. S. Yu 11 Oct. 1985 12 p Presented at the SDIO/DARPA Annual Propagation Review, Monterey, Calif., 24 Jun. 1985
(Contract W-7405-eng-48)
(DE86-002135; UCRL-92876; CONF-8506141-13) Avail: NTIS HC A02/MF A01

A numerical simulation has been constructed to obtain a detailed, quantitative estimate of the electromagnetic fields and currents existing in the Advanced Test Accelerator under conditions of laser guiding. The code treats the secondary electrons by particle simulation and the beam dynamics by a time-dependent envelope model. The simulation gives a fully relativistic description of secondary electrons moving in self-consistent electromagnetic fields. The calculations are made using coordinates t, x, y, z for the electrons and t, ct-z, r for the axisymmetric electromagnetic fields and currents. Code results, showing in particular current enhancement effects, will be given. DOE

N86-24441# Stanford Linear Accelerator Center, Calif.
LIFETIME OF HEAVY FLAVOUR PARTICLES
V. Lueth Oct. 1985 30 p refs Presented at the 5th International Conference on Physics in Collision, Autun, France, 3 Jul. 1985 Prepared in cooperation with European Organization for Nuclear Research, Geneva, Switzerland
(Contract DE-AC03-76SF-00515)
(DE86-002157; SU-SLAC-PUB-3808; CERN-EP-85-142; CONF-850785-4) Avail: NTIS HC A03/MF A01

Recent measurements of the lifetime of the tau leptons and charm and beauty hadrons are reviewed and their significance for the couplings of the charged weak current, flavor mixing, and models relating quarks to hadron decay are discussed. DOE

N86-24442# Oak Ridge National Lab., Tenn.
ION MICROPROBE MASS SPECTROMETRY USING SPUTTERING ATOMIZATION AND RESONANCE IONIZATION
D. L. Donohue, W. H. Christie, and D. E. Goeringer 1985 4 p refs Presented at the 5th International Conference on Ion Mass

Spectrometry, Washington, D.C., 29 Sep. 1985
(Contract DE-AC05-84OR-21400)
(DE86-002270; CONF-8509197-1) Avail: NTIS HC A02/MF A01

Resonance ionization mass spectrometry (RIMS) has recently been developed into a useful technique for isotope ratio measurements. Studies performed have been reported for a variety of elements using thermal vaporization sources to produce the atom reservoir for laser-induced resonance ionization. A commercial ion microprobe mass analyzer (IMMA) has been interfaced with a tunable pulsed dye laser for carrying out resonance ionization mass spectrometry of sputtered atoms. The IMMA instrument has many advantages for this work, including a micro-focused primary ion beam (2 microns in diameter) of selected mass, complete sample manipulation and viewing capability, and a double-focusing mass spectrometer for separation and detection of the secondary or laser-generated ions. Data were obtained demonstrating the number and type of ions formed along with optical spectral information showing the wavelengths at which resonance ionization occurs. DOE

N86-24443# Los Alamos National Lab., N. Mex.
DO NUCLEONS DISSOLVE
T. Goldman 1985 13 p refs Presented at the Nuclear Chromodynamics Conference, Santa Barbara, Calif., 12 Aug. 1985
(Contract W-7405-eng-36)
(DE86-002407; LA-UR-85-3700; CONF-8508127-5) Avail: NTIS HC A02/MF A01

A model is presented which describes multiquark, nuclear-like systems in a manner consistent with QCD, and with nuclear properties. Within the model, it is found that quasi-nucleon structures describe the minimum energy state of the system. This result is due to a balance between quarks lowering their kinetic energy by spreading out through the system, and lowering their color-magnetic spin-spin interaction energy by forming nucleon-like clusters. A strong core repulsion is evident, as is a realistic dip in the central matter density of the (4)He-like, 12-quark system. DOE

N86-24444# Argonne National Lab., Ill.
HEAVY MESON DECAYS AND p ANTI p COLLISIONS
E. L. Berger, P. H. Damgaard, and K. Tsokos 1985 6 p Presented at the International Conference on Hadron Spectroscopy, College Park, Md., 20 Apr. 1985 Prepared in cooperation with European Organization for Nuclear Research, Geneva, Switzerland and Maryland Univ., College Park
(Contract W-31-109-eng-38)
(DE86-003044; ANL/HEP-CP-85-111; CONF-8504133-11) Avail: NTIS HC A02/MF A01

We use the formalism of exclusive processes at high momentum transfer, to give predictions for the decay of the 2(++)chi state into a p anti p pair and the production cross section for chi in p anti p collisions. DOE

N86-24445# Stanford Linear Accelerator Center, Calif.
RECENT OPERATIONAL PERFORMANCE OF THE CERN OMEGA RING IMAGING CERENKOV DETECTOR
R. J. Apsimon, P. S. Flower, K. A. Freeston, G. D. Hallewell, J. A.G. Morris, J. V. Morris, C. N. Paterson, P. H. Sharp, C. N. Uden, and M. Davenport Oct. 1985 10 p Presented at the IEEE Nuclear Science Symposium, San Francisco, Calif., 23 Oct. 1985 Prepared in cooperation with Rutherford Appleton Lab., Chilton, England, European Organization for Nuclear Research, Geneva, Switzerland, Manchester Univ., England and Sheffield Univ., England
(Contract DE-AC03-76SF-00515)
(DE86-002810; SU-SLAC-PUB-3816; CONF-851009-6) Avail: NTIS HC A02/MF A01

We discuss the design and construction of the Time Projection Chambers (TPCs) of the Omega Ring Imaging Cerenkov Detector (RICH). Details are given of the TPC high voltage system and its monitoring and control. In addition, the operation and monitoring of the readout is described together with results of tests on the performance of the front end amplifiers. The operation of the RICH TPCs and electronics during the first data run of WA69, in 1984, is discussed together with relevant results from laboratory tests. Results from the preliminary analysis of a sample of data from the 1984 run are also presented. DOE

N86-24446# California Univ., Berkeley. Lawrence Berkeley Lab.
STEADY-STATE FEL: PARTICLE DYNAMICS IN THE FEL PORTION OF A TWO-BEAM ACCELERATOR
E. Sternbach and A. M. Sessler Sep. 1985 37 p Presented at the 7th International Free-electron Laser Conference, Tahoe City, Calif., 8 Sep. 1985
(Contract DE-AC03-76SF-00098)
(DE86-002866; LBL-19939; CONF-850956-10) Avail: NTIS HC A03/MF A01

Motivated by its use in a Two-Beam Accelerator, we have studied a steady-state FEL; i.e., a periodic but very long structure in which the electron beam energy is replenished once a period with a short induction acceleration unit. We have studied longitudinal particle motion in such a device using a 1-D simulation code. We show that after an initial start-up section, particle detrapping from the pondermotive wave is minimal in a steady-state FEL of several kilometers. A simple linear model of particle diffusion is shown to describe the numerical results quite well. DOE

N86-24447# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho.
CAPABILITIES OF THE ATHENA COMPUTER CODE FOR MODELING THE SP-100 SPACE REACTOR CONCEPT
C. D. Fletcher Sep. 1985 48 p
(Contract DE-AC07-76ID-01570)
(DE86-003213; EGG-RST-7025) Avail: NTIS HC A03/MF A01

The capability to perform thermal-hydraulic analyses of an SP-100 space reactor was demonstrated using the ATHENA computer code. The preliminary General Electric SP-100 design was modeled using Athena. The model simulates the fast reactor, liquid-lithium coolant loops, and lithium-filled heat pipes of this design. Two ATHENA demonstration calculations were performed simulating accident scenarios. A mask for the SP-100 model and an interface with the Nuclear Plant Analyzer (NPA) were developed, allowing a graphic display of the calculated results on the NPA. DOE

N86-24448# Los Alamos National Lab., N. Mex.
SPACE NUCLEAR SAFETY PROGRAM Progress Report, Mar. 1984
R. W. Zocher, comp. and T. G. George, comp. Aug. 1985 31 p
(Contract W-7405-eng-36)
(DE86-003278; LA-10511-PR) Avail: NTIS HC A03/MF A01

This technical monthly report covers studies related to the use of PuO2-238 in radioisotope power systems carried out for the Office of Special Nuclear Projects of the US Department of Energy by Los Alamos Laboratory. They are divided into: general-purpose heat source, lightweight radioisotope heater unit, and safety technology program. DOE

N86-24449# Los Alamos National Lab., N. Mex.
ION SOURCES FOR HIGH-FREQUENCY ACCELERATORS
R. Keller 1985 45 p refs Translation into ENGLISH of "Ionenquellen fur Hochfrequenzbeschleuniger" Rept. 41-18-02 VDI-Bildungswerk, Berlin, West Germany, 3 May 1982 Prepared in cooperation with Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt, West Germany
(Contract W-7405-eng-36)
(DE86-003563; LA-tr-85-16-Rev) Avail: NTIS HC A03/MF A01

Ion sources are being applied increasingly in many areas of physics and technology, from basic research in nuclear and atomic physics to energy research, isotope separation, implanation technology, surface processing and analysis all the way to biomedicine. It is impossible within the framework of this discussion to provide a comprehensive survey of the variety of available source types. The function and problems of the types important for high-frequency accelerators are to be explained using a few individual examples in order to stimulate a basic understanding

for this technically sophisticated and little-known equipment. The sources discussed here supply singly or multiply charged, positive ions. DOE

N86-24450# Stanford Linear Accelerator Center, Calif.
SLAC THREE-BODY PARTIAL WAVE ANALYSIS SYSTEM
D. Aston, T. A. Lasinski, and P. K. Sinervo Oct. 1985 37 p refs (Contract DE-AC03-76SF-00515)
(DE86-003794; SLAC-287) Avail: NTIS HC A03/MF A01

We present a heuristic description of the SLAC-LBL three-meson partial wave model, and describe how we have implemented it at SLAC. The discussion details the assumptions of the model and the analysis, and emphasizes the methods we have used to prepare and fit the data. DOE

N86-24451# Argonne National Lab., Ill.
PRODUCTION OF VIBRATIONALLY COLD ION USING A RADIO FREQUENCY STORAGE ION SOURCE
A. Sen 1985 15 p refs Presented at the Symposium of Northeastern Accelerator Personnel, Argonne, IL., 14 Oct. 1985 (Contract W-31-109-eng-38)
(DE86-004056; CONF-851040-3) Avail: NTIS HC A02/MF A01

A storage ion source has been built for the production of vibrationally cold H2(+) and H3(+) ions. Using a gas mixture of H2 and rare gases (Ne and He) in the source at high pressure, higher vibrational states of these ions have been effectively depleted by ion-molecule reactions and collisional deactivation. The internal energy of the cold ions were determined by the threshold measurement of collision-induced dissociation. With a mixture of H2 and Ne (ratio 1:5) in the source operated at 80 mtorr, H2(+) ions were found to be in v = 0 and 1 states only and the H3(+) ions were in the ground vibrational state. DOE

N86-24380# Joint Publications Research Service, Arlington, Va.
INELASTIC INTERACTIONS OF HIGH ENERGY HADRONS WITH NUCLEONS AND NUCLEI OF PHOTOEMULSION AND THE CLUSTERIZATION PHENOMENON Abstract Only
Marianna Ivanovna Tretyakova *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-004) 7 Feb. 1986 p 45 Transl. into ENGLISH from Akademiya Nauk SSSR Ordena Lenina Fizicheskiy Inst. Imeni P. N. Lebedeva (Moscow, USSR), 1984 p 3-48 (For primary document see N86-24358 14-70)
Avail: NTIS HC A06

N86-24381# Joint Publications Research Service, Arlington, Va.
COMPLETE INTERACTION CROSS-SECTIONS OF ULTRACOLD NEUTRONS WITH GASEOUS DEUTERIUM Abstract Only
Ye. Z. Akhmetov, V. N. Barshentsev, M. M. Kadykenov, D. K. Kaipov, M. D. Kaipov, and N. K. Kospanov *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-004) 7 Feb. 1986 p 46 Transl. into ENGLISH from Izvestiya Akademii Nauk Kazakhskoy SSR: Seriya Fiziko-Matematicheskaya (Alma-Ata, USSR), no. 6, Nov. - Dec. 1984 p 1-2 (For primary document see N86-24358 14-70)
Avail: NTIS HC A06

74 OPTICS

Includes light phenomena.

N86-24452 Rochester Univ., N. Y.
UNIQUENESS AND OTHER ASPECTS OF THE OPTICAL PHASE PROBLEM Ph.D. Thesis
Bryan Joseph Brames 1985 267 p
Avail: Univ. Microfilms Order No. DA8528538

The phase problem is examined as it occurs in stellar speckle interferometry, wherein one assumes that the image to be reconstructed is of finite spatial extent. Algorithms for reconstructing the Fourier phase of an image are studied, as well as a detailed investigation of the two-dimensional uniqueness question undertaken. Criteria for unique phase retrieval are derived for two-dimensional discrete objects, with particular emphasis placed on the importance of support constraints. It is established that some, such as Eisenstein's support, ensure a single solution independent of the function defined on that region, excluding mild restrictions necessary to define the region. An alternate method of demonstrating the solution uniqueness associated with Eisenstein's support is presented. Moreover, this approach is generalized to produce a large number of supports which are not described by Eisenstein's criterion, but which nonetheless guarantee solution uniqueness. Dissert. Abstr.

N86-24453# Stanford Univ., Calif. Information Systems Lab.
OPTICAL COMPUTING RESEARCH Annual Report, 18 May 1984 - 17 May 1985
Joseph W. Goodman, Raymond Kostuk, Ellen Ochoa, and Bradley Cylmer 1 Jun. 1985 124 p
(Grant AF-AFOSR-0166-83)
(AD-A162272; SU-ISL-L722-10; AFOSR-85-1037TR) Avail: NTIS HC A06/MF A01 CSCL 09/3

Research accomplished under AFOSR Grant No. AFOSR 83-0166 during the time period 18 May 1984 through 17 May 1985 is described. The work covers Several different areas of optical computing and related topics are discussed. The primary emphasis of the work is on applications of optics to interconnections in the area of microelectronics. A second area of investigations is the inversion of images and wavefronts using photorefractive crystals, and the applications of such nonlinear operations to spatial filtering problems. Work has also been completed on the wavefront inversion using holograms and on the suppression of speckle in coherently formed images. Publications during the last year arising out of the grant are also listed. Author (GRA)

N86-24454# Aerodyne Research, Inc., Billerica, Mass.
OPTICAL SYSTOLIC ARRAY PROCESSORS Final Report, Jun. 1984 - Jun. 1985
H. J. Caulfield, Scott Israel, and Roger Putnam Sep. 1985 49 p
(Contract F30602-84-C-0130)
(AD-A162383; ARI-4657; RADC-TR-85-162) Avail: NTIS HC A03/MF A01 CSCL 09/2

Multiplication with 16 bit accuracy can be accomplished by optical means and is competitive and superior in speed to fully electronic devices if a sum-of-products algorithm is being implemented. The advantage of optics is not in the multiply function where electronic multipliers will be generally faster due to the extra analog-to-digital converters needed in the optical device. The optics advantage appears when many of the resulting numerical products need to be added which is accomplished by integrating sequential light pulses onto one detector. The bottleneck for digital addition is the arithmetic carry terms which are evaluated sequentially. We also present and analyze a threshold logic analog-to-digital converter intended for the optical multiplier which demonstrates increased speed over a successive approximation A/D without the complexity of a flash converter. We also present a significant step which is the sideways summer. The sideways summer greatly reduces the time required for the one step of electronic addition which is part of the digital-multiplication by analog-convolution algorithm. This electronic addition is needed to convert the resulting mixed binary form of the output into a normal binary number. GRA

N86-24455# Honeywell, Inc., Bloomington, Minn.
NONLINEAR OPTICAL PHENOMENA IN SOLIDS Final Technical Report, 1 Sep. 1981 - 15 Jun. 1985
Paul W. Kruse and David K. Arch 15 Jul. 1985 31 p
(Contract F49620-81-C-0034)
(AD-A162394; AFOSR-85-1036TR) Avail: NTIS HC A03/MF A01 CSCL 20/12

The nonlinear optical properties of Hg(1-x)Cd(x)Te for x values between 0.20 and 0.23 have been evaluated experimentally under C02 laser excitation at 295 K, 77K, and 12 K. Optical phase conjugation arising from conduction band nonparabolicity and the photoexcited plasma mechanisms has been studied. A new effect in which the phase conjugate signal is erased or quenched by means of a separate C02 laser has been observed. The mechanism

depends upon an enhanced Auger recombination rate due to two-photon absorption. Optical absorption data were obtained on eight samples of Hg(1-x)Cd(x)Te over the interval from 10 to 40 micrometers and interpreted theoretically in terms of interband, intraband, impurity, and lattice absorption measurements. The temporal behavior of degenerate four-wave mixing and optical bistability was studied theoretically for a superlattice or quantum well for both absorptive (photoexcited plasma) and dispersive (conduction band nonparabolicity) mechanisms. The third order susceptibility due to both conduction band nonparabolicity and the photoexcited plasma mechanisms in both GaAs/Al(x)Ga(1-x)As and Hg(1-x)Cd(x)Te/Hg(1-y)Cd(y)Te superlattices has been investigated theoretically. GRA

N86-24456# Science Applications International Corp., McLean, Va.
PROCEEDINGS OF IMAGE UNDERSTANDING WORKSHOP HELD AT MIAMI, FLORIDA ON 9-10 DECEMBER 1985 Annual Technical Report, Oct. 1984 - Dec. 1985
Lee S. Baumann Dec. 1985 534 p Workshop held in Miami, Fla., 9-10 Dec. 1985
(Contract MDA903-84-C-0160; ARPA Order 3456)
(AD-A162898; SAIC-85/1149) Avail: NTIS HC A23/MF A01 CSCL 20/6

Presented are the outlines of annual progress reports and technical papers of the research activities in Image Understanding, sponsored by the Information Processing Techniques Office; Defense Advanced Research Projects Agency. The papers were delivered at a workshop conducted on 9-10 December 1985, in Miami Beach, Florida. Also included are copies of invited papers presented at the workshop and additional technical papers from the research activities which were not presented due to lack of time but are germane to this research field. Author (GRA)

N86-24457# United Technologies Research Center, East Hartford, Conn.
COMPOSITE INTEGRAL RESPONSE SENSING Final Technical Report, Aug. 1982 - Mar. 1985
J. R. Dunphy, G. Meltz, and R. M. Elkow Sep. 1985 116 p
(Contract F08635-83-C-0287)
(AD-A163136; AD-E801242; UTRC/R85-926546-20; AFATL-TR-85-37) Avail: NTIS HC A06/MF A01 CSCL 20/6

The investigation of a new concept for measurement of distributed strain is described. Implementation of the technique utilizes a fiber optic device with twin, coupled cores, a single input and a single output. Multiple wavelength operation of the sensor yields a diagnosis of the waveguide coupling perturbations imposed by mechanical disturbances. A general theory for the device has been derived in the form of an integral equation that relates the sensor core contrast to an arbitrary bending strain or curvature. In many cases of interest the curvature is small and slowly varying. For these conditions theory shows the core crosstalk spectrum is directly related to the Fourier transform of the strain distribution on a cantilevered beam. GRA

N86-24458# Department of the Navy, Washington, D. C.
HIGH STABILITY FIBER OPTIC MAGNETIC FIELD SENSOR WITH ENHANCED LINEAR RANGE USING MAGNETIC FEEDBACK NULLING Patent Application
K. P. Koo, G. H. Sigel, A. B. Tveten, and A. Danridge, inventors (to Navy) Filed 7 Nov. 1985 16 p
(AD-D012055; US-Patent-Appl-SN-795949) Avail: NTIS HC A02/MF A01 CSCL 20/3

This patent application discloses a fiber optic interferometer-type magnetic field sensor which uses an automatic feedback system to limit the range of the magnetic field experienced by the sensor element. A high frequency bias field is mixed with the external magnetic field to be measured and the resulting interferometer output signal is converted to an electric output signal. The electric output signal is mixed with a reference signal having the same frequency as the bias signal to form a baseband negative feedback signal which is converted to a magnetic field and mixed with the bias and external fields to provide automatic feedback. GRA

N86-24459# Department of the Navy, Washington, D. C.
FIBER OPTIC MICROBEND PHASE SHIFTER AND MODULATOR Patent Application
Henry F. Taylor, inventor (to Navy) Filed 26 Sep. 1985 15 p
(AD-D012060; US-Patent-Appl-SN-780495) Avail: NTIS HC A02/MF A01 CSCL 20/6

The present invention relates generally to a fiber optic phase shifter and intensity modulator and more particularly to fiber optic phase shifters and modulators that utilize a microbend transducer. The ability to shift the phase of light propagating in a single mode fiber is quite useful in fiber optic sensors and may also be used in fiber-optic communications. A conventional way to shift the phase of light propagating in a single mode fiber is by stretching the fiber. This is done by wrapping and gluing the fiber around a cylinder of piezoelectric material. When a voltage is applied to the material, the cylinder expands thereby stretching the fiber. Long lengths on the order of 10 meters of fiber and large voltages are needed to drive the piezoelectric cylinder. The ability to modulate the intensity of light propagating in a optic fiber is also useful in fiber optic communication and sensing systems. Such modulation can be performed by a device external to the fiber such as an electrooptic modulator formed in a lithium niobate crystal. GRA

N86-24460# Department of the Navy, Washington, D. C.
GLASS COMPOSITIONS FOR PRODUCING PRESSURE AND TEMPERATURE INSENSITIVE OPTICAL FIBER COATINGS AND OPTICAL FIBERS THEREFROM Patent Application
Douglas Blackburn, Albert Feldman, and Nicolas Lagakos, inventors (to Navy) Filed 10 Dec. 1985 27 p
(AD-D012069; US-Patent-Appl-SN-807150) Avail: NTIS HC A03/MF A01 CSCL 11/2

This invention relates generally to glass compositions and more particularly to low compressibility, low expansivity glass compositions for use with optical fibers. Pressure and temperature insensitive optical fibers are produced using a Ta205 based glass composition which has a high bulk modulus and a low thermal expansion coefficient. The glass composition can function as the classing in the optical fiber or as a protective coating which surrounds the cladding thereby protecting the fiber from fluctuations in temperature and pressure. GRA

N86-24461# California Univ., Berkeley. Lawrence Berkeley Lab.
DETERMINING OPTIMUM SECTOR SIZE FOR AUTOMATIC LIGHTING CONTROLS
F. Rubinstein, R. Verderber, and M. Karayel Jul. 1985 23 p Presented at the Illuminating Engineering Society (IES) Annual Technical Conference, Detroit, Mich., 21 Jul. 1985
(Contract DE-AC03-76SF-00098)
(DE86-004103; LBL-19474; CONF-8507101-1) Avail: NTIS HC A02/MF A01

Automatic lighting controls can significantly reduce operating costs in commercial buildings. However, the design of these dynamically operated lighting systems has not kept pace with advancements in equipment. This paper focuses on determining how many lights should be grouped into sectors and controlled as a unit in order to minimize the life-cycle cost of an automatically controlled lighting system. The analysis is based on occupant behavior patterns, the cost of the lighting controls, the energy costs, and a decision criterion based on life-cycle cost. DOE

N86-24462# Systemberatung Informatik, Karlsruhe (West Germany).
DEVELOPMENT OF AN OPTICAL DATA PROCESSOR DEMONSTRATION MODEL Final Report
M. Bohner, P. Gemmar, H. Kazmierczak, and F. Zimmermann Paris ESA Jul. 1984 174 p refs
(Contract ESTEC-4672/81-NL-HP)
(ESA-CR(P)-2127) Avail: NTIS HC A08/MF A01

A hybrid-optical correlator combined with digital electronics for

flexible data selection and exploitation as a compact, transportable opto-electric arrangement for remote sensor downlinking is discussed. The improvement and fabrication of a liquid crystal image transducer used in the optical correlator, and the performance of incoherent and coherent image conversion are described. Optical and electronic system parts, and their control and operation are outlined. Theoretical limits of optical correlation achieved from digital simulation are compared with experimental results from the implemented hybrid optical-electronic correlator interfaced to a host computer. Automatic location and verification of binary patterns in an image scene are demonstrated with the correlator system. Hybrid-optical correlation for real time and real world applications is assessed. Author (ESA)

N86-24463# National Bureau of Standards, Washington, D.C. Electromagnetic Technology Div.
DIRECT MEASUREMENT OF THE ELECTRIC FIELD OF A LASER PULSE-THEORY
E. G. Johnson Aug. 1985 60 p
(PB86-132743; NBS/TN-1084) Avail: SOD HC $2.25 as SN003-003-02697-2 CSCL 20F

An electric field measuring apparatus is considered using optical processing, tapered optical filters, and a pair of detectors at the end of each optical fiber. Using an appropriate computer-generated optical filter, the author shows it is possible to discriminate among a set of orthonormal modes used to represent the spatial features of the electric field with a signal-to-noise ratio of at least 100 to 1. If the positioning accuracies for various parts of the apparatus are properly set up, it is expected that the signal-to-noise ratio could be bout 1000. The purpose of the tapered and graded-index fiber is to select the fundamental propagating mode in a fiber and to attenuate the other modes. The existence of this fiber allows the precise determination of the strength of each of the orthonormal fields before the optical processing. The paper presents the conflicts in the design and gives a solution. The complete evaluation requires assembly of the proposed apparatus to assess final accuracy. GRA

N86-24382# Joint Publications Research Service, Arlington, Va.
EXPERIMENTAL INVESTIGATION OF RADIATION SCATTERING BY MULTICOMPONENT POLYDISPERSE SYSTEMS OF PARTICLES Abstract Only
F. B. Yurevich, G. M. Yatskevich, V. A. Fogelev, and S. M. Karas *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-004) 7 Feb. 1986 p 48 Transl. into ENGLISH from Teplofizika Vysokikh Temperatur (Moscow, USSR), v. 22, no. 6, Nov. - Dec. 1984 p 1146-1151 (For primary document see N86-24358 14-70)
Avail: NTIS HC A06

N86-24383# Joint Publications Research Service, Arlington, Va.
DIFFRACTION OF LIGHT BY ULTRASOUND IN OPTICALLY ACTIVE UNIAXIAL CRYSTALS Abstract Only
G. Ye. Zilberman, L. F. Kupchenko, and G. F. Goldvyanskaya *In its* USSR Report Physics and Mathematics (JPRS-UPM-86-004) 7 Feb. 1986 p 51 Transl. into ENGLISH from Radiotekhnika I Elektronika (Moscow, USSR), v. 29, no. 12, Dec. 1984 p 2449-2454 (For primary document see N86-24358 14-70)
Avail: NTIS HC A06

N86-24384# Joint Publications Research Service, Arlington, Va.
INFLUENCE OF DESIGN PARAMETERS OF PARABOLIC MIRROR SEGMENT ON IMAGE CHARACTERISTICS IN COHERENT OPTICAL PROCESSING SYSTEM Abstract Only
Ye. A. Dudkina *In its* USSR Report Physics and Mathematics (JPRS-UPM-86-004) 7 Feb. 1986 p 59 Transl. into ENGLISH from Optiko-Mekhanicheskaya Promyshlennost (Leningrad, USSR), no. 7, Jul. 1984 p 26-27 (For primary document see N86-24358 14-70)
Avail: NTIS HC A06

N86-24385# Joint Publications Research Service, Arlington, Va.
LASER RADIATION WAVEFRONT CONJUGATION IN FIBER OPTIC LIGHTGUIDES Abstract Only
A. A. Chertkov *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-004) 7 Feb. 1986 p 61 Transl. into ENGLISH from Pisma V. Zhurnal Tekhnicheskoy Fiziki (Leningrad, USSR), v. 10, no. 23, 12 Dec. 1984 p 1214-1420 (For primary document see N86-24358 14-70)
Avail: NTIS HC A06

N86-24621*# California Univ., San Diego. Center for Astrophysics and Space Sciences.
OPTICAL IMAGING SPECTROSCOPY
Richard C. Canfield *In* NASA. Marshall Space Flight Center Solar Flares and Coronal Physics Using P/OF as a Research Tool Apr. 1986 p 120-131 refs (For primary document see N86-24614 14-92)
(Grants NsG-7406; NSF AST-83-20306; NSF ATM-84-15793; AF-AFOSR-3071-76; AF-AFOSR-0092-82)
Avail: NTIS HC A14/MF A01 CSCL 20F

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N86-24464 Cornell Univ., Ithaca, N.Y.
ON THE KELVIN-HELMHOLTZ INSTABILITIES OF SUPERSONIC/SUPERALFVENIC SHEAR LAYERS Ph.D. Thesis
Sudipto Roy Choudhury 1985 224 p
Avail: Univ. Microfilms Order No. DA8516958

A number of space and astrophysical plasma configurations are characterized by velocity shear layers with a velocity change across layer of thickness. The stability properties of finite-thickness compressible shear layers is examined. Two different velocity profiles are investigated in detail using the analogy between the pressure distribution, and the bound and scattering wave states of the one dimensional Schrodinger equation. By analytical and numerical methods, fairly complete contour maps were generated for the real and imaginary parts of the wave frequency as a function of the two free dimensionless parameters, the reduced Mach number, and the wavenumber. The stability of finite-thickness, compressible, magnetized shear layers is also investigated numerically. A formulation is derived for investigating the stability of low temperature, collisionless shear layers in the presence of a magnetic field parallel to the macroscopic flow. The numerical rsults obtained are applied to the boundary of the solar wind and the Earth's magnetosphere. Connections to satellite observations are discussed. A method of studying the nonlinear saturation of the fastest growing traveling wave modes is considered.
Dissert. Abstr.

N86-24465 Stevens Inst. of Tech., Hoboken, N. J.
AN EXPERIMENTAL INVESTIGATION OF HIGH ENERGY ION BEAM PRODUCTION IN THE PLASMA FOCUS Ph.D. Thesis
Charles William Powell 1985 192 p
Avail: Univ. Microfilms Order No. DA8522796

The energy spectrum of the ion beam produced along the electrode axis of a 5 kJ plasma was determined for ion energy values in the interval 0.3 MeV $< E <$ 7.6 MeV (for D + ions). The characteristics of the experiment are: the analyzed energy range extends far beyond the maximum of other laboratory determinations; a high resolution delta E/E which is substantially higher than the best resolution obtained in any other determination; measurement of the energy/charge state spectrum of heavy (impurity) ions present in the ion beam is extended beyond previous energy limits; possibility to detect the presence of quasi-neutral ion clusters, whose small magnetic deflection would prevent them from being separated from the neutral beam component of the plasma focus emission in smaller spectrometers; and determination of the energy spectrum dependence on such important plasma focus parameters as filling pressure and D-D fusion neutron yield.
Dissert. Abstr.

N86-24466 Princeton Univ., N. J.
FAST ION EFFECTS ON MAGNETIC INSTABILITIES IN THE PDX TOKAMAK Ph.D. Thesis
Dean Alan Buchenauer 1985 224 p
Avail: Univ. Microfilms Order No. DA8529031

Modification and excitation of nondisruptive magnetic instabilities due to near perpendicular neutral beam injection on the PDX tokamak were made to determine the importance of these instabilities at low q. The instabilities consisted of resistive MHD modes, beam driven ideal MHD modes, and beam driven ion cyclotron modes. Evidence of enhanced transport is presented for several of these instabilities as well as comparison of the experimental results with theory. Possible consequences for reactor type tokamaks and high power auxiliary heating systems are discussed. Dissert. Abstr.

N86-24467 Colorado Univ., Boulder.
THE ROLE OF THREE-WAVE SCATTERING IN THE SATURATION OF ELECTRON-BEAM DRIVEN LANGMUIR WAVES Ph.D. Thesis
Jeffrey Allen Casey 1985 153 p
Avail: Univ. Microfilms Order No. DA8528469

Theory predicts that the three wave backscatter of electron beam driven Langmuir waves is stimulated by ion-acoustic waves of frequency 2 omega sub pC sub s/V sub b (omega sub p = plasma frequency, c sub s = ion acoustic speed, v sub b = beam velocity). Suppression of Langmuir wave growth should therefore result from scattering away from wave-numbers destabilized by the electron beam. This effect is observed in an unmagnetized double plasma device (electron temperature is approximately 5 eV, electron density approximately 3 x 10 to the 8th power/cu. cm. in argon), by externally introducing narrow band ion acoustic turbulence into an electron beam plasma system. Suppression of electron beam resonant Langmuir wave growth is seen when tuning the low frequency turbulence through the predicted resonance at 2 omega sub p c sub s/v sub b. In addition, as the intensity of ion-acoustic waves increases, greater suppression of Langmuir wave growth occurs. Also presented are design details of the automated, computerized electron distribution function analysis system; and exact numerical calculations of the dispersion relation for driven Langmuir waves. Dissert. Abstr.

N86-24468 Princeton Univ., N. J.
SOME ASPECTS OF ANOMALOUS TRANSPORT IN TOKAMAKS: STOCHASTIC MAGNETIC FIELDS, TEARING MODES AND NONLINEAR BALLOONING INSTABILITIES Ph.D. Thesis
Steven Charles Cowley 1985 139 p
Avail: Univ. Microfilms Order No. DA8529033

Various problems int he theory of anomalous transport in tokamaks are investigated. A general overview of the current theories of confinement is presented. The q greater than one and less than two region is studied since this region is the thermall insulating region of the tokamak. Stochastic magnetic field transport is not important to the insulating region, because drift tearing modes are stable in this region. A discussion of flux surface breakup is given. Tearing modes are shown to be, stable in an equilibrium without islands and unstable in an equilibrium with islands. It is therefore proposed that tearing modes observed in experiments originate as equilibrium islands which may be caused by nonaxisymmetry of the device. The nonlinear evolution of ideal ballooning modes in a simple model is investigated. The saturation mechanism is shown to be the flattening of the density gradient by the instability. One surprising feature of the evolution is the lack of mode coupling in the poloidal wavenumber spectrum. Dissert. Abstr.

N86-24469 Colorado Univ., Boulder.
THEORETICAL INVESTIGATION OF LAMINAR AND TURBULENT UNSTEADY BOUNDARY LAYERS ALONG A FLAT PLATE Ph.D. Thesis
Ismail Omar Hindash 1985 152 p
Avail: Univ. Microfilms Order No. DA8528491

Viscous, incompressible, and unsteady boundary layer flows along flat plates were investigated. Unsteady flows are divided into two major parts. First laminar and impulsive, constant and other types of accelerated fluid flows, starting from rest, are solved by using similarity variables. A physical model is presented and justified for these type of flows. The solutions are enerated by computer. The results provide the first singularity free semi-similar solutions that show the development and growth of the boundary layer long a semi-infinite flat plate. Self-generated unsteadiness, turbulence, is divided into two kinds. The first kind is the turbulent boundary layer fluid flows, with constant mainstream velocity, along a semi-infinite flat plate. The numerical results show the development of the boundary layer starting from the laminar through the fully developed turbulent regions, including transition. The second kind is the turbulent boundary layer fluid flows, with constant and impulsively started mainstream velocity, along an infinite flat plate. The computer results show the growth of the boundary layer from laminar through the fully turbulent regions, including transition. Dissert. Abstr.

N86-24470# Toronto Univ., Downsview (Ontario). Inst. for Aerospace Studies.
STUDY OF LOW-Z COATINGS FOR JET UNDER EXPOSURE TO ELECTRONS, LASER RADIATION AND ATOMIC HYDROGEN
A. A. Haasz, J. W. Davis, O. Auciello, and P. C. Stangeby Feb. 1986 38 p refs
(UTIAS-303; ISSN-0082-5255) Avail: NTIS HC A03/MF A01

In an attempt to lower radiation losses due to metal plasma impurities in the JET fusion device, the use of low-Z wall coatings has been proposed (Si, TiC, SiC, TiO2, Al2O3 and MgAl2O4 on Inconel 600). Experimental results tained by exposing these samples to electron, laser radiation and atomic hydrogen impact are presented. The studies performed include measurements of (1) gases evolved due to low energy (3000 eV) electron bombardment, (2) inherent gas content in the near-surface region, and (3) retained deuterium subsequent to exposure to sub-eV D sup 0. Electron impact desorption rates for hydrogen and methane due to electron bombardment span the range 10 to the minus 1 power to 10 to the minus 3 power H2/e(-) and 10 to the minus 2 to < 10 to the minus 4 power Ch4/e(-). Following normal system bakeout at 500 K for 24h, the major species released by laser heating were found to be H2 and CO, with levels up to approx. 7 x 10 to the 16th power H/sq cm and approx. 4 x 10 to the 16th power CO/sq cm. A similar concentration of argon was found for the TiC coating produced by sputter ion plating. Further heating of the samples to 800 to 900K for 1h resulted in a reduction of hydrogen and CO release levels by about an order of magnitude. Subsequent to the 800 to 900 K heating procedure, the samples were exposed to sub-eV D sup 0 atoms to fluences of approx. 2; x 10 to the 19th power D sup zero/sq cm, and deuterium retention levels were measured to be of the order of 10 to the 14th power - 10 to the 15th power D/sq cm for the various coatings. Implications of these results for JET's first-wall tritium inventory are discussed. Author

N86-24471# Nagoya Univ. (Japan). Inst. of Plasma Physics.
BEHAVIOUR OF THE PERIPHERAL PLASMA IN THE REVERSED FIELD PINCH
A. Matsuoka, K. I. Sato, H. Arimoto, S. Yamada, A. Nagata, and H. Murata Jan. 1986 14 p refs
(IPPJ-763) Avail: Issuing Activity

By using Langmuir probes installed behind limiters, time behavior of the peripheral plasma in the Reversed Field Pinch (RFP) are investigated. The behavior of the peripheral plasma is strongly affected by the confined RFP plasma and is divided into three phases (the initial phase before setting up the RFP configuration, the current rising phase, and the quiescent phase), which is just the same as those of the confined RFP plasma. Typical behavior of the peripheral plasma have relations to the pump out phenomena and of the toroidal flux generation. Author

N86-24472# Nagoya Univ. (Japan). Inst. of Plasma Physics.
PRODUCTION OF HIGHLY RELATIVISTIC IONS AND ELECTRONS BY QUASI-PERPENDICULAR MAGNETOSONIC SHOCK

WAVES
Yukiharu Ohsawa Jan. 1986 14 p refs
(IPPJ-764) Avail: Issuing Activity

It is shown that a non-relativistic theory for laminar shocks breaks down for a plasma having a rather high Alfven speed, V sub A approx. > sq r + c (m sub e/m subi). By using a 2-1/2 dimension, fully relativistic, fully electromagnetic particle code, time evolution of quasi-perpendicular shocks in such plasmas is studied. Some ions and electrons are accelerated simultaneously to highly relativistic speeds by the shock. Author

N86-24473# Stevens Inst. of Tech., Hoboken, N. J.
MEGA-AMP OPENING SWITCH WITH NESTED ELECTRODES/ PULSED GENERATOR OF ION AND ION CLUSTER BEAMS Annual Report, 1 Jul. 1984 - 30 Jun. 1985
V. Nardi, C. M. Luo, and C. W. Powell 1 Jul. 1985 36 p
(Grant AF-AFOSR-0228-84)
(AD-A162850; AFOSR-85-1125TR) Avail: NTIS HC A03/MF A01 CSCL 20/9

During the first year of the research program on the use of a plasma focus machine (PF) as a M Amp opening switch we have: (1) Improved the performance of our presently functioning system by finding a new method of increasing the surge of anamalous (i.e., noncollisional) resistivity which controls the switch opening function (specifically, the rate of disintegration of the PF pinch where the current is concentrated); (2) Devised new methods to monitor the rate of disintegration of the PF pinch via the changes of the particle emission spectra as a function of time (on a nanosec scale) and of position (on a 50 micrometer scale) inside the pinch; and (3) Made substantial progress in the construction of an upgraded system which can operate at higher current levels as compared to the present 0.5 - 0.7 MA. Author (GRA)

N86-24474# Oak Ridge National Lab., Tenn.
WEIGHT CHANGE MEASUREMENTS OF EROSION/ DEPOSITION AT BERYLLIUM LIMITER TILES IN ISX-B
J. B. Roberto, P. H. Edmonds, A. C. England, A. Gabbard, and R. A. Zuhr Jul. 1985 13 p Presented at the 32nd National Vacuum Symposium and Topical Conference, Houston, Tex., 19 Nov. 1985
(Contract DE-AC05-84OR-21400)
(DE86-002246; CONF-851174-12) Avail: NTIS HC A02/MF A01

The weight changes of Be tiles which functioned as a rail limiter in ISX-B for more than 3500 beam-heated discharges have been determined. The net weight loss for the limiter was 2.0 g, with the central tiles losing a total of 3.2 g and inboard tiles gaining 1.2 g. The weight loss is attributed primarily to the release of Be droplets as a result of limiter surface melting. The weight gains resulted from an inward flow of molten material along the limiter surface. The results indicate high erosion (melt loss) with incomplete and nonuniform redeposition (melt flow) of limiter material during periods of limiter melting. DOE

N86-24475# Los Alamos National Lab., N. Mex.
OBSERVATION OF THE 16.7 MeV D-T FUSION GAMMA USING A GAS CERENKOV DETECTOR
J. S. Ladish, J. W. Toevs, C. S. Young, P. Nash, S. Iversen, P. Zagarino, L. Jennings, and R. D. Seno 1985 4 p refs Presented at the IEEE Nuclear Science Symposium, San Francisco, Calif., 23 Oct. 1985 Prepared in cooperation with Edgerton, Germeshausen and Grier, Inc., Goletta, Calif. and Edgerton, Germeshausen and Grier, Las Vegas, Nev.
(Contract W-7405-eng-36)
(DE86-002411; LA-UR-85-3674; CONF-851009-5) Avail: NTIS HC A02/MF A01

A measurement of the 16.7 MeV gamma production in a D-T fusion plasma was performed, using a four channel carbon dioxide gas Cerenkov detector system to measure the Cerenkov light generated by the gamma conversion electrons produced in a thin aluminum foil. DOE

N86-24476# Los Alamos National Lab., N. Mex.
DISCRETE-COIL INVESTIGATIONS OF MODULAR STELLARATOR CONFIGURATIONS
C. G. Lilliequist Oct. 1985 47 p
(Contract W-7405-eng-36)
(DE86-003280; LA-10504-MS) Avail: NTIS HC A03/MF A01

The existence of a vacuum magnetic well is generally accepted as a prerequisite to start-up. The special set of modular-stellarator configurations selected for the present computational investigation was derived from coefficients and equations that produced finite-beta wells in a continuous-current-sheet representation. The corresponding coils did not produce magnetic wells in a vacuum when their field configuration was investigated with a discrete-coil code. Vacuum magnetic wells have been identified through the use of this discrete-coil code in previous Heliac and stellarator studies. Therefore, these finite-beta magnetic wells could be the consequence of the continuous-current-sheet model, a conjecture that is supported by the linear scaling of the magnetic hills found in the present work as a function of the separation between the coils used. In addition to magnetic field profiles, comparisons are shown here of ripple, rotational transform, and flux-surface shapes for the discrete-coil, modular stellarators under study. Initially, each of the significant parameters affecting the shape of the control surface upon which the coils lie and the deformation of the individual coils was varied separately in search of a vacuum magnetic well in the parameter neighborhood of the successful finite-beta configuration. DOE

N86-24477# Oak Ridge National Lab., Tenn.
POTENTIAL MEASUREMENTS IN TANDEM MIRRORS
J. C. Glowienka Nov. 1985 19 p
(Contract DE-AC05-84OR-21400)
(DE86-002902; ORNL/TM-9705) Avail: NTIS HC A02/MF A01

The US mirror program has begun conducting experiments with a thermal barrier tandem mirror configuration. This configuration requires a specific axial potential profile and implies measurements of potential for documentation and optimization of the configuration. This report briefly outlines the motivation for the thermal barrier tandem mirror and then outlines the techniques used to document the potential profile in conventional and thermal barrier tandem mirrors. Examples of typical data sets from the world's major tandem mirror experiments, TMX and TMX-U at Lawrence Livermore National Laboratory (LLNL) and Gamma 10 at Tsukuba University in Japan, and the current interpretation of the data are discussed together with plans for the future improvement of measurements of plasma potential. DOE

N86-24478# Texas Univ., Austin. Inst. for Fusion Studies.
DIAMAGNETIC STABILITY LIMIT FOR HOT PARTICLE PLASMAS
H. L. Berk and Y. Z. Zhang Oct. 1985 41 p
(Contract DE-FG05-80ET-53088)
(DE86-003127; DOE/ET-53088/199; IFSR-199) Avail: NTIS HC A03/MF A01

The layer precessional mode is analyzed at arbitrary drift reversal by using a cylindrical model with embedded currents which simulate the role of field line curvature in actual mirror experiments. New effects are included by taking into account the Landau damping arising from the spread of hot particle drift orbits. It is found that the mode is destabilized slightly below the value that drift reversal is achieved. Its growth rate is proportional to N(-4) where N(-2) is a coupling constant. In addition the unstable interaction of the precessional layer mode with surface waves which can propagate below and above the ion cyclotron frequency is described. Below the ion cyclotron frequency the surface wave resembles the Alfven wave, while above the ion cyclotron frequency the surface wave resembles a whistler wave. DOE

N86-24479# Los Alamos National Lab., N. Mex.
MULTIPOINT THOMSON SCATTERING SYSTEM AND MEASUREMENTS ON THE LOS ALAMOS SPHEROMAK COMPACT TOROID EXPERIMENT
R. Gribble, T. R. Jarboe, H. W. Hoida, J. Lipson, and E. W. Newman Sep. 1985 13 p
(Contract W-7405-eng-36)

(DE86-003297; LA-10528-MS) Avail: NTIS HC A02/MF A01

A multipoint Thomson scattering system providing radial electron temperature and density profiles of plasma in a single shot is an on-line diagnostic on the spheromak device of CTX. The system includes a 22-joule, dual-beam ruby laser, large collection optics, and a spectrophotometer that contains a 40-mm dual chevron micro-channel-plate image intensifier tube as shutter and first stage of light amplification. A unique method of calibration that uses an 870-mm-long tungsten rod light source for instrument transmission and linearity measurements is described. Examples of data and temperature profiles are presented. DOE

N86-24480# Massachusetts Inst. of Tech., Cambridge. Plasma Fusion Center.

LOWER HYBRID HEATING EXPERIMENTS IN TOKAMAKS: AN OVERVIEW

M. Porkolab Oct. 1985 29 p Presented at the Course and Workshop on Applications of RF Waves To Tokamak Devices, Varenna, Italy, 5 Sep. 1985

(Contract DE-AC02-78ET-51013)

(DE86-003363; DOE/ET-51013/162; PFC/CP-85-9; CONF-8509192-2) Avail: NTIS HC A03/MF A01

Lower hybrid wave propagation theory relevant to heating fusion grade plasmas (tokamaks) is reviewed. A brief discussion of accessibility, absorption, and toroidal ray propagation is given. The main part of the paper reviews recent results in heating experiments on tokamaks. Both electron and ion heating regimes will be discussed. The prospects of heating to high temperatures in reactor grade plasmas will be evaluated. DOE

N86-24481# JAYCOR, San Diego, Calif.

PRODUCTION OF ULTRAHIGH MAGNETIC FIELDS Technical Progress Report

25 Oct. 1985 103 p

(Contract DE-FG03-84ER-13302)

(DE86-003735; DOE/ER-13302/1) Avail: NTIS HC A06/MF A01

The objective was to produce and measure controlled ultra-high magnetic fields by imploding a plasma in which a magnetic field has been entrained. The novel method for producing the ultrahigh fields using a gas-puff Z pinch was tested successfully and found to work as well as predicted in some respects and better in others, such as field amplification. Moreover, in testing this concept, we may have created the only megagauss facility in the world with a 3 minute repetition rate and long lifetime. Most megagauss facilities are single-shot, owing to material deformations or the use of explosives. DOE

N86-24482# Sandia National Labs., Albuquerque, N. Mex.

DEVELOPMENT OF A TWELVE-PLASMA GUN, SINGLE-PULSER COMBINATION FOR USE IN THE PBFA-1 HYBRID ION DIODE

P. F. McKay Oct. 1985 26 p refs

(Contract DE-AC04-76DP-00789)

(DE86-003797; SAND-85-1741) Avail: NTIS HC A03/MF A01

A twelve-plasma gun, single-pulser combination for use in the PBFA-I 15-cm Hybrid Ion Diode is described. Each gun will generate a plasma density of 1 x 10(12) cm(-3) at a distance of 15 cm. Included are results of preliminary experiments to determine the required pulser energy and a practical gun geometry. DOE

N86-24483# Lawrence Livermore National Lab., Calif.

ODRIC: A ONE-DIMENSIONAL LINEAR RESISTIVE MHD CODE IN CYLINDRICAL GEOMETRY

A. A. Mirin, R. J. Bonugli, N. J. ONeill, and J. Killeen Oct. 1985 36 p

(Contract W-7405-eng-48)

(DE86-003798; UCRL-93503) Avail: NTIS HC A03/MF A01

The primitive resistive MHD equations in cylindrical geometry are time-advanced. Fourier analysis in the poloidal and toroidal directions and subsequent linerization are performed, resulting in a 1-D (radial) system for the perturbed quantities. Separate equations for the electron and ion temperature perturbations are solved. Hall terms and the thermal force vector are included in Ohm's law. Anisotropic thermal conductivity and viscosity are included in the model. DOE

N86-24484# Oak Ridge National Lab., Tenn.

SIMPLE CONTOUR ANALYSIS OF IGNITION CONDITIONS AND PLASMA OPERATING REGIMES IN TOKAMAKS

N. A. Uckan, J. Sheffield, and E. C. Selcow 1985 6 p Presented at the 11th Symposium on Engineering Problems in Fusion Research, Austin, Tex., 18 Nov. 1985

(Contract DE-AC05-84OR-21400)

(DE86-003324; CONF-851102-14) Avail: NTIS HC A02/MF A01

Contour plots of ignition, auxiliary power requirements, heating and operating windows, optimal path to ignition, ignition margin, etc., are generated analytically in terms of a small number of parameters for classes of devices with equivalent performance. Numerical studies are carried out to map the physics design space. Considering both the Murakami density limit results from analytic calculations indicate that in a standard tokamak geometry devices with a b02q sub * approx. 20 should be ignitable provided confinement does not degrade with heating power; however, aB02q sub * approx. 30 to 25 may be required for minimal ignition for a typical L- (H-) mode confinement scaling. Increased plasma elongation (kappa approx. 2) may help to reduce these requirements. DOE

N86-24371# Joint Publications Research Service, Arlington, Va.

INFLUENCE OF LASER RADIATION WAVELENGTH ON PARAMETERS OF FORMING PLASMA Abstract Only

A. V. Dobkin and I. V. Nemchinov *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-004) 7 Feb. 1986 p 24 Transl. into ENGLISH from Pisma V Zhurnal Tekhnicheskoy Fiziki (Leningrad, USSR), v. 10, no. 23, 12 Dec. 1984 p 1426-1430 (For primary document see N86-24358 14-70)

Avail: NTIS HC A06

N86-24378# Joint Publications Research Service, Arlington, Va.

MHD OSCILLATIONS ON PERIPHERY OF PLASMA FILAMENT IN L-2 STELLARATOR DURING OHMIC HEATING Abstract Only

S. Ye. Grebenshchikov, B. I. Kornev, and S. V. Shchepetov *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-004) 7 Feb. 1986 p 41 Transl. into ENGLISH from Akademiya Nauk SSSR, Inst. Obshchey Fiziki (Moscow, USSR), 1984 (For primary document see N86-24358 14-70)

(Preprint-178) Avail: NTIS HC A06

N86-24386# Joint Publications Research Service, Arlington, Va.

MAGNETIC REARRANGEMENT AND CHANGE IN PLASMA CONCENTRATION DURING DISRUPTION OF CURRENT LAYER Abstract Only

S. Yu. Bogdanov, G. V. Dreyden, I. I. Komissarova, V. S. Markov, G. V. Ostrovskaya, Yu. I. Ostrovskiy, V. N. Filippov, A. G. Frank, A. Z. Khodzhayev, and Ye. N. Shedova *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-004) 7 Feb. 1986 p 65 Transl. into ENGLISH from Akademiya Nauk SSSR Inst. Obshchey Fiziki (Moscow, USSR), 1984 (For primary document see N86-24358 14-70)

(Preprint-179) Avail: NTIS HC A06

N86-24387# Joint Publications Research Service, Arlington, Va.

NUMERICAL MODELING OF UNIDIMENSIONAL QUASILINEAR RELAXATION OF RELATIVISTIC ELECTRON BEAM IN INHOMOGENEOUS PLASMA WITH COLLISIONS Abstract Only

K. G. Gureyev, M. G. Nikulin, and A. B. Sionov *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-004) 7 Feb. 1986 p 68 Transl. into ENGLISH from Zhurnal Tekhnicheskiy Fiziki (Leningrad, USSR), v. 55, no. 1, Jan. 1985 p 215-217 (For primary document see N86-24358 14-70)

Avail: NTIS HC A06

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

N86-24485# Dayton Univ., Ohio. Research Inst.
13(C) NMR AND X-RAY CRYSTALLOGRAPHIC DETERMINATION OF THE STRUCTURES OF SOME ISOMERIC PHENYLQUINOXALINES Final Report, May 1979 - Oct. 1981
Frederick L. Hedberg, Donna L. Bush, Mary T. Ryan, Robert A. Harvey, and Albert V. Fratini May 1985 28 p Prepared in cooperation with Arizona Univ., Tucson
(Contracts F33615-78-C-5126; F33615-80-K-5156)
(AD-A161882; AFWAL-TR-85-4037) Avail: NTIS HC A03/MF A01 CSCL 07/4

The good thermal and hydrolytic stability of polyphenylquinoxalines has prompted many investigations for characterization and property correlations for these polymers. The presence of isomers in polyphenylquinoxalines as a result of the ring forming polymerization reaction has been noted. The existence of isomers contributes to the amorphous form of these polymers and inhibits crystalline polymer formation. Unequivocal structural assignments were made for the two isomeric quinoxalines isolated from the reaction of 3-bromobenzil with 4-iodo-O-phenylenediamine as well as for their respective acetylene terminated derivatives. The higher melting isomers were assigned the structures 3-(3-bromophenyl)-2-phenyl-6-iodoquinoxaline and 3-(3-ethynylphenyl)-2-phenyl-6-ethynylquinox-aline, and the lower melting isomers were assigned the structures 2-(3-bromophenyl)-3-phenyl-6-iodoquinoxaline and 2-(3-ethynylphenyl)-3-phenyl-6-ethynylquinoxaline. Both X-ray crystallographic analysis and C-13 NMR analyses were used and were in complete agreement. GRA

N86-24486# State Univ. of New York, Stony Brook. Dept. of Physics.
X-RAY ABSORPTION FINE STRUCTURE STUDIES OF SEMICONDUCTOR SUPERLATTICES Annual Report, 1 Aug. 1984 - 31 Jul. 1985
Yi-Han Kao 30 Aug. 1985 6 p
(Contract N00014-83-K-0675)
(AD-A162031) Avail: NTIS HC A02/MF A01 CSCL 07/4

First application of extended X-ray absorption fine structure (EXAFS) technique to measurements of interatomic distance, local order, and strain in semiconductor superlattices and heterostructures has been successfully demonstrated. This result opens many possibilities for obtaining unique structural information in various semiconductors. GRA

N86-24487# Rensselaer Polytechnic Inst., Troy, N.Y. Dept. of Mechanical Engineering Aeronautical Engineering and Mechanics.
ANALYTICAL INVESTIGATIONS OF BULK WAVE RESONATORS IN THE PIEZOELECTRIC THIN FILM ON GALLIUM-ARSENIDE CONFIGURATION Annual Report, 1 Sep. 1984 - 31 Aug. 1985
Harry F. Tiersten 30 Sep. 1985 10 p
(Grant AF-AFOSR-0351-84)
(AD-A162068; AFOSR-85-1042TR) Avail: NTIS HC A02/MF A01 CSCL 09/5

Trapped energy modes in the piezoelectric thin film on semiconductor composite resonator are explained and contrasted with modes that do not trap energy. The results of calculation of the quality factor of the fundamental essentially thickness-extensional mode in the composite resonator due to radiation into the bulk semiconductor wafer are discussed. The calculations were performed for two configurations of the composite resonator thick in which the mode is not trapped and for a configuration in which the mode is trapped. The combination of materials was aluminum-nitride on gallium-arsenide. The calculations show that when trapping is not present the quality factor is a very rapidly varying function of the ratio of the composite resonator thickness to the wafer thickness and that the range of variation is very large, i.e., between one and two orders of magnitude. The calculations also reveal that when trapping is present the quality factor is always much larger and its range of variation with thickness ratio much smaller than when trapping is not present. GRA

N86-24488# Massachusetts Inst. of Tech., Cambridge.
INFRARED NONLINEAR PROCESSES IN SEMICONDUCTORS Semiannual Technical Report, 1 Dec. 1984 - 31 May 1985
P. A. Wolff, R. L. Aggarwal, D. M. Larsen, S. Y. Yuen, and E. Isaacs 24 Jun. 1985 7 p
(Contract F49620-84-C-0010)
(AD-A162096; AFOSR-85-0994TR) Avail: NTIS HC A02/MF A01 CSCL 20/12

Observation of exceedingly narrow spin flip lines in n-InSb suggests the existence of spin waves in this crystal. Si:P has been shown to have a large nonlinear optic coefficient at the metal-insulator transition; the effect is believed to be due to electron promotion from localized to delocalized states. Preliminary nonlinear optic experiments imply that hole kinetics in p-type InGaAs/GaAs strained layer superlattices are different from those of bulk p-GaAs. Author (GRA)

N86-24489# Stanford Univ., Calif. Dept. of Materials Science and Engineering.
FABRICATION AND PROPERTIES OF MULTILAYER STRUCTURES Final Technical Report, 1 Nov. 1982 - 30 Jun. 1985
William A. Tiller Oct. 1985 318 p
(Contract MDA903-83-K-0041)
(AD-A162347; SU-DMS-86-R-1) Avail: NTIS HC A14/MF A01 CSCL 20/2

Computer modeling of Si and SiC surfaces and surface processes relevant to crystal growth from the vapor and molecular beam epitaxy has been carried out. Surface point defect energies, ledge energies and face energies, as well as the surface stress tensor, have been calculated. The strongly compressive surface stress tensor has been found to dominate all surface reconstruction processes. Experimental studies of SiC film formation via dual source and single source sputtering processes is described in an attempt to produce almost single crystal SiC films. GRA

N86-24490# Army Military Personnel Center, Alexandria, Va.
THE EFFECT OF A BIMODAL GRAIN SIZE DISTRIBUTION ON THE COMPRESSIVE STRENGTH OF POLYCRYSTALLINE ICE M.S. Thesis
James L. Laughlin Dec. 1985 105 p
(AD-A162361) Avail: NTIS HC A06/MF A01 CSCL 08/12

Previous studies have shown that grain size directly affects the strength of fresh-water equiaxed polycrystalline ice Ih, where strength decreases as grain size increases. This has been shown both in tension and compression at constant strain rates over a range of temperatures. The mechanical behavior of the ice is well described by the Hall-Petch relation. This thesis presents the results of a study to examine the effect of a bimodal grain size distribution on the compressive strength of equiaxed randomly oriented polycrystalline ice Ih. Laboratory prepared specimens of right circular ice consisting of different amounts of large (5.5 mm) and small(2.0 mm) grains by volume (75%/25L%, 50%/50%, 25%-75%) were tested at -10 C in uniaxial unconfined compression. Tests were conducted at two strain rates, 0.00001/S and 0.001/s. Building on the results of Cannon (1985), this work establishes the law of mixtures for the compressive strength of a specimen composed of a bimodal mix of grains. First hypotheisized by Lee(1985), the law of mixtures states that the strength of a bimodal specimen is linearly dependent on the volume fraction of large and small grains. A single significant grain size may be used to charcterize the mechanical behavior of the specimen. Two possible candidates of a significant grain size are examined, one derived from the use of the Hall-Petch relation and the second being the average of the two grain sizes. Results show the use of the average is more expedient with little loss in accuracy. GRA

N86-24491# Northwestern Univ., Evanston, Ill. Dept. of Physics.

SUPERLATTICE EFFECTS IN GRAPHITE INTERCALATION COMPOUNDS Annual Report, 1 Oct. 1984 - 30 Sep. 1985
R. S. Markiewicz 22 Oct. 1985 30 p
(Contract F49620-82-C-0076)
(AD-A162373; AFOSR-85-1038TR) Avail: NTIS HC A03/MF A01 CSCL 20/3

A new kind of two-dimensional, field-induced phase transition has been discovered in Br2 graphite intercalation compounds. Similar to, but much more pronounced than Condon domain formation in three-dimensions, it is a Landau level instability which results in two types of domains having different numbers of Landau levels occupied. The domains display a striking nonlinear dynamics in an a.c. magnetic field, with phenomena including resonance, hysteresis, and a quasiperiodic route to chaos. A theoretical basis for analyzing the data has been developed, and the high frequency resonance appears to be a transverse vibration of the domain array, similar to that predicted for the superconducting intermediate state. Author (GRA)

N86-24492# Akron Univ., Ohio. Inst. of Polymer Science.
INELASTIC ELECTRON TUNNELING SPECTROSCOPY OF SILANE COUPLING AGENTS ADSORBED ON ALUMINA
J. D. Alexander, A. N. Gent, and P. N. Henriksen Dec. 1985 33 p
(Contract N00014-85-K-0222)
(AD-A162849; TR-3) Avail: NTIS HC A03/MF A01 CSCL 07/4

Inelastic electron tunneling spectroscopy (IETS) has been used to obtain vibrational spectra of alkoxysilanes adsorbed on aluminum oxide. The spectra reveal that: (1) monoalkoxysilanes are not adsorbed whereas trialkoxysilanes are readily adsorbed, (2) the reaction mechanism of triethoxysilanes and trimethoxysilanes is the same, and (3) the reaction mechanism under anhydrous conditions utilizes surface OH o OD groups present on alumina. All of these results suggest the following hypotheses: Trialkoxysilanes can condense directly with OH groups on an alumina surface to form siloxane interfacial bonds. Such bonds are probably stabilized subsequently by condensation between chemisorbed silane molecules to form siloxane oligomers. On the other hand, monoalkoxysilanes appear to be unable to bond to an alumina surface, either because their reactivity is intrinsically lower or because they are not able to condense further to form a nonvolatile polysiloxane layer in situ. Their intrinsic reactivity will, of course, be reduced because they have fewer reactive sites per molecule. Nevertheless, they clearly act as catalysts for further oxidation of the aluminum surface, as evidenced by the rapid increase in junction resistance on doping the substrate with them. GRA

N86-24493# Lawrence Livermore National Lab., Calif.
MOLECULAR DYNAMICS STUDIES OF ENERGY TRANSFER PROCESSES IN CRYSTAL SYSTEM Annual Summary Report, 1 Oct. 1984 - 30 Sep. 1985
Arnold M. Karo and Franklin E. Walker 17 Dec. 1985 12 p
(Contracts N00014-85-F-0005; W-7405-eng-48)
(AD-A163132; AD-F630622; UCID-20620) Avail: NTIS HC A02/MF A01 CSCL 20/4

Computer molecular dynamics studies have been carried out on the problem of attaining a fundamental understanding of shock-induced initiation of energetic materials. The studies focus on an important specific facet of this problem, namely, the energy transfer processes in crystal systems, particularly in molecular lattices. Code development for the CRAY computer during the preceding year is reviewed and the shock studies that were carried out are listed. Plans for additional studies of the underlying mechanisms of intermolecular-intramolecular energy transfer and the dynamics of intramolecular energy exchange in shock-loaded systems are presented. GRA

N86-24494# Sandia National Labs., Albuquerque, N. Mex.
RAMAN SPECTROSCOPY OF BORON CARBIDES AND RELATED BORON-CONTAINING MATERIALS
J. A. Shelnutt, B. Morosin, D. Emin, A. Mullendore, G. Slack, and C. Wood 1985 26 p Presented at the International Conference on the Physics and Chemistry of Boron and Boron-rich Borides, Albuquerque, N. Mex. 29 Jul. 1985 Prepared in cooperation with General Electric Co., Schenectady, N.Y., and Jet Propulsion Lab., Pasadena, Calif.
(Contract DE-AC04-76DP-00789)
(DE86-002126; SAND-85-1438C; CONF-850786-4) Avail: NTIS HC A03/MF A01

Raman spectra of crystalline boron, boron carbide, boron arsenide (B12As2), and boron phosphide (B12P2) are reported. The spectra are compared with other boron-containing materials containing the boron icosahedron as a structural unit. The spectra exhibit similar features some of which correlate with the structure of the icosahedral units of the crystals. The highest Raman lines appear to be especially sensitive to the B-B distance in the polar triangle of the icosahedron. Such Raman structural markers are potentially useful in efforts to tailor electronic properties of these high temperature semiconductors and thermoelectrics. Raman spectroscopy is also useful in characterizing methods of preparation of boron-based materials. For example, inclusions of carbonaceous material in the boron carbides can be detected by the presence of two broad Raman lines near 1370 and 1580 cm(-1). In the hot-pressed samples that exhibited the lines the carbonaceous material is amorphous and much like carbon black or pyrolytic glassy carbon. DOE

N86-24495# Emory Univ., Atlanta, Ga. Dept. of Physics.
FAR INFRARED STUDIES OF SUPERCONDUCTING V3Si, Nb3Ge AND b Final Report
S. Perkowitz 29 Aug. 1985 6 p
(Contract DE-AS05-79ER-10436)
(DE86-002318; DOE/ER-10436/5) Avail: NTIS HC A02/MF A01

Far infrared spectroscopy between 10 and 250 cm(-1) is an effective probe of superconductivity because typical gap and phonon energies lie in this region. Between 1979 and 1985, this DOE contract supported far infrared research in homogeneous high-T sub c superconductors and in granular superconductors. Results in both areas are summarized in this report. DOE

N86-24496# California Univ., Berkeley. Lawrence Berkeley Lab.
INFLUENCE OF DANGLING BOND DEFECTS ON RECOMBINATION IN A-Si:H
H. Dersch, A. Skumanich, and N. M. Amer Jun. 1985 5 p Presented at the 11th International Conference on Amorphous Semiconductors, Rome, Italy, 2 Sep. 1985
(Contract DE-AC03-76SF-00098)
(DE86-002874; LBL-20184; CONF-8509201-2) Avail: NTIS HC A02/MF A01

Time resolved photoinduced absorption (PIA) and steady state photoconductivity experiments (PC) are used to study recombination processes in electron-irradiated hydrogenated amorphous silicon (a-Si:H). Defect densities measured by ESR range from 5 x 10(15)/cm(3) to 10(18)/cm(3). It is found that while increasing the dangling bond density reduces the PC, the PIA decay rate increases. The results are discussed in the context of a recombination model where the defect density determines whether the carriers recombine through a fast bimolecular or a slower monomolecular process. DOE

N86-24497# Sandia National Labs., Albuquerque, N. Mex.
EPITAXIAL FORMATION OF RARE EARTH SILICIDES BY RAPID ANNEALING
J. A. Knapp and S. T. Picraux 1985 12 p Presented at the Materials Research Society Meeting, Boston, Mass., 2 Dec. 1985
(Contract DE-AC04-76DP-00789)
(DE86-003568; SAND-85-1333C; CONF-851217-6) Avail: NTIS HC A02/MF A01

Rapid electron beam and lamp heating have been used to form thin epitaxial films of rare-earth silicides by reacting overlayers of the rare earths with (111) Si substrates. Of the metals Y, Gd, Tb, Dy, Ho, Er, Tm, Yb, and Lu, all but Gd are found to form epitaxial silicide layers by rapid solid-phase reaction, while silicides of Gd, Dy, Tm, Yb and Lu have been formed epitaxially by liquid phase reaction. For all but Er this is the first demonstration of

epitaxial growth on Si. Details obtained from ion beam channeling analysis and transmission electron microscopy confirm the expected epitaxial structure and also show that the Si vacancies in the silicide form an ordered superlattice, rather than a random array as had been assumed before. DOE

N86-24498# Sandia National Labs., Albuquerque, N. Mex.
CONDUCTION BAND ENERGY LEVELS IN SUPERLATTICES WITH COMPLEX UNIT CELLS
G. C. Osbourn 1985 10 p Presented at the Materials Research Society Meeting, Boston, Mass., 2 Dec. 1985
(Contract DE-AC04-76DP-00789)
(DE86-003715; SAND-85-1636C; CONF-851217-9) Avail: NTIS HC A02/MF A01

The conduction band energy levels and wavefunctions in a number of superlattices with more than two layers per unit cell have been calculated using an effective mass model. Many of these structures exhibit energy levels which can be modeled as resulting from a conventional superlattice with a modified bulk conduction band minimum in the effective wells. These structures should be useful for extending the size of the superlattice periods in strained-layer superlattices. DOE

N86-24499# California Univ., Berkeley. Lawrence Berkeley Lab.
DETECTION OF CHARGED PARTICLES IN AMORPHOUS SILICON LAYERS
S. N. Kaplan, J. R. Morel, T. A. Mulera, V. Perez-Mendez, G. Schnurmacher, and R. A. Street Oct. 1985 7 p refs Presented at the IEEE Nuclear Science Symposium, San Francisco, Calif., 23 Oct. 1985 Prepared in cooperation with Xerox Palo Alto Research Center, Calif.
(Contract DE-AC03-76SF-00098)
(DE86-003992; LBL-19665; CONF-851009-30) Avail: NTIS HC A02/MF A01

The successful development of radiation detectors made from amorphous silicon could offer the possibility for relatively easy construction of large area position-sensitive detectors. We have conducted a series of measurements with prototype detectors, on signals derived from alpha particles. The measurement results are compared with simple model calculations, and projections are made of potential applications in high-energy and nuclear physics. DOE

N86-24500# California Univ., Berkeley. Lawrence Berkeley Lab.
TRANSLATIONS AND STRUCTURE IN SYMMETRICAL TILT BODY-CENTERED-CUBIC GRAIN BOUNDARIES
E. A. Kamenetzky, R. Gronsky, and Y. T. Chou Oct. 1985 11 p Presented at the 4th Japan Institute of Metals International Symposium (JIMIS-4) on Grain Boundary Structure and Related Phenomena, Minakami Spa, Japan, 25 Nov. 1985 Prepared in cooperation with Lehigh Univ., Bethlehem, PA.
(Contract DE-AC03-76SF-00098)
(DE86-004099; LBL-20487; CONF-8511128-2) Avail: NTIS HC A02/MF A01

A simple geometrical method has been developed to calculate grain boundary translations that preserve first- and second-nearest neighbor coordination across the interface. These translations form interlocking polyhedral groups of atoms that define a mechanically stable boundary. Further individual atom relaxations can be easily recognized from the geometry of the atom arrangements. The description of boundary structure that results from this model is equivalent to a soft sphere description where a range of interatomic distances between the first and second-nearest neighbors exist at the grain boundary. A number of possible structures exist for each boundary; the relationship between these structures and the implications on grain boundary phenomena are discussed. A structural unit description results for particular sets of translations. DOE

N86-23763# Joint Publications Research Service, Arlington, Va.
CHINA DEVELOPS ADVANCED LASER CRYSTAL
In its China Report: Science and Technology (JPRS-CST-86-005) 11 Feb. 1986 p 119 Transl. into ENGLISH from Xinhua (Beijing, China), 23 Dec. 1985 (For primary document see N86-23762 14-31)
Avail: NTIS HC A07/MF A01

N86-23766# Joint Publications Research Service, Arlington, Va.
FLUORESCENT SPECTRA OF Cr3+ IONS IN OXIDES OF HIGH VALENT-CATIONS, POSSIBILITY TO USE THEM AS TUNABLE LASER MATERIALS Abstract Only
Zundu Luo, Jiming Chen, and Tao Chen *In its* China Report: Science and Technology (JPRS-CST-86-005) 11 Feb. 1986 p 132 Transl. into ENGLISH from Hongwai Yanjiu (Shanghai, China), v. 4, no. 5, Oct. 1985 p 355-360 (For primary document see N86-23762 14-31)
Avail: NTIS HC A07/MF A01

N86-23767# Joint Publications Research Service, Arlington, Va.
DATA ANALYSIS OF INFRARED REFLECTION SPECTRA OF LiNbO3 AND OTHER CRYSTALS Abstract Only
Yan Liu and Liji Liao *In its* China Report: Science and Technology (JPRS-CST-86-005) 11 Feb. 1986 p 137 Transl. into ENGLISH from Gunagxue Xuebao (Shanghai, China), v. 5, no. 11, Nov. 1985 p 1046-1055 (For primary document see N86-23762 14-31)
Avail: NTIS HC A07/MF A01

N86-24360# Joint Publications Research Service, Arlington, Va.
RESISTANCE OF YAG:Nd SUP 3+ LASER FREQUENCY CONVERTERS TO IONIZING RADIATION Abstract Only
B. I. Zakharkin, L. A. Kulevskiy, V. N. Nikolayev, and G. N. Toropkin *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-004) 7 Feb. 1986 p 3 Transl. into ENGLISH from Akademiya Nauk SSSR Inst. Obshchey Fiziki (Moscow, USSR), no. 58 (For primary document see N86-24358 14-70)
Avail: NTIS HC A06

N86-24361# Joint Publications Research Service, Arlington, Va.
RAMAN SCATTERING OF LIGHT IN GALLIUM-ARSENIDE CRYSTALS EXPOSED TO SUBNANOSECOND LASER PULSES Abstract Only
I. I. Reshina, O. V. Smolskiy, and A. N. Vasilyev *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-004) 7 Feb. 1986 p 4 Transl. into ENGLISH from Fizika I Tekhnika Poluprovodnikov (Leningrad, USSR), v. 19, no. 2, Feb. 1985 p 252-256 (For primary document see N86-24358 14-70)
Avail: NTIS HC A06

N86-24362# Joint Publications Research Service, Arlington, Va.
LACK OF CORRESPONDENCE OF LATTICE PERIODS AND INTENSITY OF PHOTOLUMINESCENCE IN GinSbAs/GaSb HETEROCOMPOSITIONS Abstract Only
N. A. Bert, V. I. Vasilyev, S. G. Konnikov, V. I. Kuchinskiy, A. S. Lazutka, V. A. Mishurnyy, and Ye. L. Portnoy *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-004) 7 Feb. 1986 p 5 Transl. into ENGLISH from Pisma Zhurnal Tekhnicheskoy Fiziki (Leningrad, USSR), v. 11, no. 4, 26 Feb. 1985 p 193-196 (For primary document see N86-24358 14-70)
Avail: NTIS HC A06

N86-24363# Joint Publications Research Service, Arlington, Va.
BLEACHING EFFECT IN ALKALI-HALIDE CRYSTALS WITH ELECTRON COLOR CENTERS Abstract Only
B. A. Medvedev, T. G. Silkina, and G. V. Simonenko *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-004) 7 Feb. 1986 p 6 Transl. into ENGLISH from Optika I Spektroskopya (Leningrad, USSR), v. 57, no. 6, Dec. 1984 p 1026-1028 (For primary document see N86-24358 14-70)
Avail: NTIS HC A06

N86-24370# Joint Publications Research Service, Arlington, Va.
LOCALIZATION AND THERMAL STABILITY OF DEFECTS CAUSED BY LASER RADIATION OF GERMANIUM Abstract Only
P. K. Kashkarov and A. V. Petrov *In its* USSR Report: Physics and Mathematics (JPRS-UPM-86-004) 7 Feb. 1986 p 18 Transl. into ENGLISH from Fizika I Tekhnika Poluprovodnikov (Leningrad, USSR), v. 19, no. 2, Feb. 1984 p 234-236 (For primary document see N86-24358 14-70)
Avail: NTIS HC A06

N86-24540*# Claflin Coll., Orangeburg, S.C. Dept. of Mathematics, Physics and Computer Science.
INVESTIGATION OF LOW-TEMPERATURE SEMICONDUCTOR DEVICES
D. R. Overcash *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 11 p refs (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 20L

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N86-24501 Louisiana State Univ., Baton Rouge.
1. TOWARD THE QUANTUM LIMIT IN GRAVITATIONAL WAVE DETECTORS. 2: SEVERAL THEORETICAL PROBLEMS IN CONDENSED MATTER PHYSICS Ph.D. Thesis
Bu-Xin Xu 1985 227 p
Avail: Univ. Microfilms Order No. DA8526392

A gravity wave detector consisting of a Weber type resonant antenna, an inductive transducer and a dc SQUID coupling system were analyzed. The complete set of equations of motion were derived for the system and their implications and solutions were discussed in detail. The results obtained are applied to the LSU gravity wave detector, and the optimum system parameters are calculated. It is possible to approach quantum limited sensitivity for the detector if these optimum system parameters and matching conditions are properly satisfied. Preliminary experimental results were presented. A critical comparison of the work of Ramana and Rajagopal (RR) with the work of McDonald (MD) on the spin polarized relativistic electron gas system was presented. After correcting some errors in previous work of RR, a new analytical expression for exchange energy and exchange potential which are convenient for practical applications are then derived. The effects of the underlying crystal structure and the surface/interface normal on spin waves at surfaces and interfaces for cubic crystals described by the Heisenberg Hamiltonian were examined. Dissert. Abstr.

N86-24502 Texas Univ., Austin.
THE HAMILTONIAN FORMULATION OF SUPERGRAVITY IN ELEVEN DIMENSIONS Ph.D. Thesis
Alvaro Hernan Diaz 1985 75 p
Avail: Univ. Microfilms Order No. DA8527555

The Hamiltonian for 11 dimensional supergravity is computed. Throughout the work the freedom to perform local supersymmetric transformations, local Lorentz rotations of the orthonormal frame, and coordinate reparametrizations was maintained. Next, the form of the algebra of generators of localized translations, supersymmetry transformations, localized rotations, and gauge transformations of the three index photon for supergravity in eleven dimensions is determined. Dissert. Abstr.

N86-24503# State Univ. of New York, Binghamton. Dept. of Chemistry.
CONGRUENT VAPORIZATION IN THE v-si SYSTEM AS STUDIED BY HIGH TEMPERATURE KNUDSEN CELL MASS SPECTROMETRY
Clifford E. Myers and Robert J. Kematick 26 Nov. 1985 7 p Presented at the Annual Conference, Mass Spectrometry and Allied Topics (33rd), San Diego, Calif., 26-31 May 1985
(Contract N00014-82-K-0501)
(AD-A162285; TR-4) Avail: NTIS HC A02/MF A01 CSCL 07/4

The vaporization behavior of vanadium silicides has been investigated by Knudsen cell mass spectrometry in the temperature range 1800-2000K. It was demonstrated that at about 1900-2000K the congruently vaporizing composition is within the V3Si single phase region. Thermodynamic activities relative to the solid elements were obtained by direct comparison. Free energies and enthalpies of phase formation for V3Si(s) and V5Si3(s) were calculated from the experimental data and were found to be in good agreement with data obtained elsewhere. GRA

N86-24504# State Univ. of New York, Binghamton. Dept. of Chemistry.
VAPORIZATION THERMODYNAMICS OF CHROMIUM SILICIDES
C. E. Myers, G. A. Murray, R. J. Kematick, and M. A. Frisch 26 Nov. 1985 15 p Presented at the Symposium, High Temperature Materials Chemistry 3, Las Vegas, Nev., 13-18 Oct. 1985
(Contract N00014-82-K-0501)
(AD-A162286; TR-5) Avail: NTIS HC A02/MF A01 CSCL 07/2

The vaporization thermodynamics of the chromium-silicon system have been investigated in the temperature range 1300-1600K by Knudsen cell mass spectrometry. Both magnetic sector and quadrupole instruments were employed. Thermodynamic activities were obtained by direct comparison with the elements. Standard free energies of formation at 1500K, Delta G deg (sub f)/R (kilokelvins) are: 1/3 CrSi2, -3.07; 1/2 CrSi, -3.62; 1/8 Cr5Si3, -3.73; 1/4 Cr3Si, -3.28. These data, when combined with heat capacity and entropy data from the literature, give standard enthalpies of formation at 298.15K, Delta H deg (sub f)/R (kilokelvins): 1/3 CrSi2, -3.36; 1/2 CrSi, -3.20; 1/8 Cr5Si3, -3.38; 1/4 Cr3Si, -3.39. The CrSi2 phase was found to contain the congruently vaporizing composition. GRA

N86-24505# Texas Univ., Austin. Center for Studies in Statistical Mechanics.
BEHAVIOR OF MATTER UNDER NONEQUILIBRIUM CONDITIONS: FUNDAMENTAL ASPECTS AND APPLICATIONS IN ENERGY-ORIENTED PROBLEMS
I. Prigogine 1985 27 p refs
(Contract DE-AS05-81ER-10947)
(DE86-003771; DOE/ER-10947/4) Avail: NTIS HC A03/MF A01

During the past year we attempted to clarify the way bifurcations of periodic solutions are organized near a homoclinic orbit associated with an unstable periodic solution. Our principal motivation is to explain various types of bifurcations sequences observed in nonlinear dynamic. DOE

N86-24506# California Univ., Berkeley. Lawrence Berkeley Lab.
QUANTUM CHEMISTRY BY QUANTUM MONTE CARLO: BEYOND GROUND-STATE ENERGY CALCULATIONS
P. J. Reynolds, R. N. Barnett, B. L. Hammond, R. Grimes, and W. A. Lester, Jr. Aug. 1985 17 p refs Presented at the 5th International Congress on Quantum Chemistry, Montreal, Quebec, 19 Aug. 1985
(Contract DE-AC03-76SF-00098)
(DE86-003993; LBL-20089; CONF-850859-2) Avail: NTIS HC A02/MF A01

We present recent advances with the quantum Monte Carlo (QMC) method in its application to molecular systems. The QMC method is a procedure for solving the Schroedinger equation statistically, by the simulation of an appropriate random process. The formal similarity of the Schroedinger equation with a diffusion equation allows one to calculate quantum mechanical expectation values as Monte Carlo averages over an ensemble of random walks. We have previously obtained highly accurate correlation energies for a number of molecules, as well as the singlet-triplet splitting in methylene and the barrier height for the H + H2 exchange reaction. Recently we have begun a program of extending the QMC approach to the calculation of analytic derivatives of the energy. A brief description of the approach is presented here, together with some preliminary results. In addition, we are now computing expectation values of properties other than the energy. We summarize how standard QMC must be modified, and present some results for H2 and N2. Finally, we describe preliminary work

toward the goal of obtaining accurate molecular excited states through QMC. DOE

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

N86-24507*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
RESEARCH REPORTS: 1985 NASA/ASEE SUMMER FACULTY FELLOWSHIP PROGRAM Final Report
Gerald R. Karr, ed. (Alabama Univ., Huntsville), T. Leroy Osborn, ed., James B. Dozier, ed., and L. Michael Freeman, ed. (Alabama Univ., Tuscaloosa) Jan. 1986 966 p refs Program held in Huntsville, Ala., 2-16 August 1985
(Contract NGT-01-008-021)
(NASA-CR-178709; NAS 1.26:178709) Avail: NTIS HC A99/MF E04 CSCL 05I

A compilation of 40 technical reports on research conducted by participants in the 1985 NASA/ASEE Summer Faculty Fellowship Program at Marshall Space Flight Center (MSFC) is given. Weibull density functions, reliability analysis, directional solidification, space stations, jet stream, fracture mechanics, composite materials, orbital maneuvering vehicles, stellar winds and gamma ray bursts are among the topics discussed. For individual titles, see N86-24508 through N86-24547.

N86-24508*# Furman Univ., Greenville, S.C. Dept. of Computer Science.
A MONTE CARLO STUDY OF WEIBULL RELIABILITY ANALYSIS FOR SPACE SHUTTLE MAIN ENGINE COMPONENTS c20
Kenneth Abernethy *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 13 p refs (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 21H

The incorporation of a number of additional capabilities into an existing Weibull analysis computer program and the results of Monte Carlo computer simulation study to evaluate the usefulness of the Weibull methods using samples with a very small number of failures and extensive censoring are discussed. Since the censoring mechanism inherent in the Space Shuttle Main Engine (SSME) data is hard to analyze, it was decided to use a random censoring model, generating censoring times from a uniform probability distribution. Some of the statistical techniques and computer programs that are used in the SSME Weibull analysis are described. The methods documented in were supplemented by adding computer calculations of approximate (using iteractive methods) confidence intervals for several parameters of interest. These calculations are based on a likelihood ratio statistic which is asymptotically a chisquared statistic with one degree of freedom. The assumptions built into the computer simulations are described. The simulation program and the techniques used in it are described there also. Simulation results are tabulated for various combinations of Weibull shape parameters and the numbers of failures in the samples. R.J.F.

N86-24509*# Alabama Univ., Birmingham.
CONTAINERLESS PROCESSING OF HYPERMONOTECTIC AND GLASS FORMING ALLOYS USING THE MARSHALL SPACE FLIGHT CENTER 100 METER DROP TUBE FACILITY c12
J. Barry Andrews *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 25 p refs (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 22A

Two separate projects were carried out to study alloys whose solidification structures can be strongly influenced by the presence of a container during melting and solidifications. One project involved containerless solidification of hypermonotectic Au35Rh65 alloys. This alloy exhibits liquid immiscibility over a temperature range. It has been suggested that containerless melting might be one solution to the problem of sedimentation in the dispersions of immiscible liquid phases. However, surface tension driven flows could also lead to accumulation of the minority liquid phase at the external surface of a containerlessly melted alloy. The research underway is a first step in determining the influence of containerless, microgravity processing on immiscible alloys. Nickel-niobium alloys were studied using the drop tube facility. One alloy in this system, a Ni60Nb40 alloy, is a good candidate for the formation of a bulk metallic glass. Amorphous alloys of this composition were produced using thin film and mechanical alloying techniques. However, theory indicates that if heterogeneous nucleation can be avoided, it should be possible to produce an amorphous structure in this system using a moderate cooling rate from the melt. The containerless melting and solidification capabilities of the drop tube faciltiy provide ideal conditions for a study of this type. To date, several Ni60Nb40 samples have been levitated, melted and cooled during 4.6 seconds of free fall in the 100 meter drop tube. Structures obtained are discussed. R.J.F.

N86-24510*# Alabama Univ., Birmingham. Dept. of Materials Engineering.
THE EFFECT OF GROWTH RATE ON THE COMPOSITIONAL VARIATIONS IN DIRECTIONALLY SOLIDIFIED Hg(1-x) CdSUBxSe c26
Rosalia N. Andrews *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 39 p refs (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 11F

Several Hg1-xCdxSe crystals of composition x = 0.2 were grown in a bridgman-type directional solidification furnace at varying translation rates. The influence of growth rate on both the longitudinal and radial compositional uniformity for the crystals was determined using density measurements and infrared transmission-edge mapping. Author

N86-24511*# Florida Inst. of Tech., Melbourne. Dept. of Chemical Engineering.
SPACE STATION COMMON MODULE THERMAL MANAGEMENT: DESIGN AND CONSTRUCTION OF A TEST BED c18
Ronald G. Barile *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 25 p refs (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 22B

In this project, a thermal test bed was designed, simulated, and planned for construction. The thermal system features interior and exterior thermal loads and interfacing with the central-radiator thermal bus. Components of the test bed include body mounted radiator loop with interface heat exchangers (600 Btu/hr); an internal loop with cabin air-conditioning and cold plates (3400 Btu/hr); interface heat exchangers to the central bus (13,00 0 Btu/hr); and provisions for new technology including advanced radiators, thermal storage, and refrigeration. The apparatus will be mounted in a chamber, heated with lamps, and tested in a vacuum chamber with LN2-cooled walls. Simulation of the test bed was accomplished using a DEC PRO 350 computer and the software package TKISolver. Key input variables were absorbed solar radiation and cold plate loads. The results indicate temperatures on the two loops will be nominal when the radiation and cold plate loads are in the range of 25% to 75% of peak loads. If all loads fall to zero, except the cabin air system which was fixed, the radiator fluid will drop below -100 F and may cause excessive pressure drop. If all loads reach 100%, the cabin air temperature could rise to 96 F. R.J.F.

N86-24512*# Purdue Univ., Indianapolis, Ind. Dept. of Mechanical Engineering.
METHODOLOGY OF DESIGN AND ANALYSIS OF EXTERNAL WALLS OF SPACE STATION FOR HYPERVELOCITY IMPACTS BY METEOROIDS AND SPACE DEBRIS c18

Fahim A. Batla *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 32 p refs (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 22B

The development of criteria and methodology for the design and analysis of Space Station wall elements for collisions with meteoroids and space debris at hypervelocities is discussed. These collisions will occur at velocities of 10 km/s or more and can be damaging to the external wall elements of the Space Station. The wall elements need to be designed to protect the pressurized modules of the Space Station from functional or structural failure due to these collisions at hypervelocities for a given environment and population of meteoroids and space debris. The design and analysis approach and the associated computer program presented is to achieve this objective, including the optimization of the design for a required overall probability of no penetration. The approach is based on the presently available experimental and actual data on meteoroids and space debris flux and damage assessments and the empirical relationships resulting from the hypervelocity impact studies in laboratories. Author

N86-24513*# Alabama Univ., Huntsville. Dept. of Mechanical Engineering.
DEVELOPMENT OF COMPOSITE MATERIAL TEST METHODOLOGY FOR FRACTURE TOUGHNESS/DAMAGE TOLERANCE **c24**
Mark V. Bower *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 21 p refs (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 11D

Fracture toughness testing techniques for composite materials are reviewed for simplicity, applicability to filament wound systems, and correlation with fracture mechanics preinciples. Toughness test results are repesented for homogeneous epoxy and graphite reinforced epoxy. Author

N86-24514*# Oklahoma State Univ., Stillwater.
A TECHNIQUE FOR INCORPORATING THE NASA SPACELAB PAYLOAD DEDICATED EXPERIMENT PROCESSOR SOFTWARE INTO THE SIMULATION SYSTEM FOR THE PAYLOAD CREW TRAINING COMPLEX **c61**
Dale A. Bremmer *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 13 p refs (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 09B

The feasibility of some off-the-shelf microprocessors and state-of-art software is assessed (1) as a development system for the principle investigator (pi) in the design of the experiment model, (2) as an example of available technology application for future PI's experiments, (3) as a system capable of being interactive in the PCTC's simulation of the dedicated experiment processor (DEP), preferably by bringing the PI's DEP software directly into the simulation model, (4) as a system having bus compatibility with host VAX simulation computers, (5) as a system readily interfaced with mock-up panels and information displays, and (6) as a functional system for post mission data analysis. Author

N86-24515*# Tuskegee Inst., Ala. Dept. of Electrical Engineering.
INVESTIGATION OF POTENTIAL DRIVER MODULES AND TRANSMISSION LINES FOR A HIGH FREQUENCY POWER SYSTEM ON THE SPACE STATION **c33**
Harold T. Brush *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 36 p refs (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 09C

The objective was to assess the feasibility of using the Series Resonant inverter as the driver module for the high frequency power system on the Space Station. This study evaluates the performance of the Series Resonant driver when it was operated with a dc input voltage and run through a series of tests to determine its start-up performance, response to load changes, load regulation, and efficiency. Also, this study compares the Series Resonant driver to another kind of driver that uses a Power Transistor snubber. An investigation of the various types of transmission lines is initiated. In particular, a simplified approach is utilized to describe the optimal transmission line. Author

N86-24516*# Tennessee Univ. Space Inst., Tullahoma.
LOW DENSITY GAS DYNAMIC WALL BOUNDARY CONDITIONS **c34**
Frank G. Collins *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 25 p refs (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 20D

Low density nozzles or large expansion ratio nozzles used in space experience rarefaction effects near their exit in the form of velocity slip and temperature jump at the walls. In addition, the boundary layers become very thick and there is a very strong viscous/inviscid interaction. For these reasons no existing design technique has been found to accurately predict the nozzle flow properties up to the nozzle exit. The objective of this investigation was to examine the slip boundary conditions and formulate them in a form appropriate for use with a full Navier-Stokes numerical code. The viscous/inviscid interaction would automatically be accounted for by using a compressible Navier-Stokes code. Through examination of the interaction of molecules with solid surfaces, a model for the distribution function of the reflected molecules has been determined and this distribution function has been used to develop a new slip boundary condition that can be shown to yield more realistic surface boundary conditions. Author

N86-24517*# Mississippi State Univ., Mississippi State. Dept. of Physics.
PRELIMINARY DESIGNS FOR X-RAY SOURCE MODIFICATIONS FOR THE MARSHALL SPACE FLIGHT CENTER'S X-RAY CALIBRATION FACILITY **c14**
W. L. Croft *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 19 p refs (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 14B

The objective of this investigation is to develop preliminary designs for modifications to the X-ray source of the MSFC X-Ray Calibration Facility. Recommendations are made regarding: (1) the production of an unpolarized X-ray beam, (2) modification of the source to provide characteristic X-rays with energies up to 40 keV, and (3) addition of the capability to calibrate instruments in the extreme ultraviolet wavelength region. Author

N86-24518*# Oregon Univ., Eugene. Inst. of Theoretiical Science.
CALCULATIONS ON THE PRODUCTION AND USE OF SUPERFINE HOLOGRAPHIC X-RAY GRATINGS FOR ASTROPHYSICAL OBSERVATIONS **c35**
Paul L. Csonka *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 14 p refs (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04

Superfine holograhic X-ray gratings may be produced by transferring onto metal an interference pattern generated by two branches of a sufficiently coherent X-ray beam, emitted in the form of synchrotron radiation from high energy electron storage rings. Generation of the coherent beam requires restrictions on the beam size. A calculation is presented which allows an exact evaluation of this restriction. The effect of defocusing optics on the expected resolution is also studied. Author

N86-24519*# Calhoun Community Coll., Decatur, Ala. Dept. of Natural Sciences.

FOAM FLOTATION AS A SEPARATION PROCESS c27
Ben L. Currin *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 15 p refs (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 11G

The basic principles of foam separation techniques are discussed. A review of the research concerning bubble-particle interaction and its role in the kinetics of the flotation process is given. Most of the research in this area deals with the use of theoretical models to predict the effects of bubble and particle sizes, of liquid flow, and of various forces on the aperture and retention of particles by bubbles. A discussion of fluid mechanical aspects of particle flotation is given. Author

N86-24520*# North Georgia Coll., Dahlonega. Dept. of Physics.
DENSITY AND PRESSURE VARIABILITY IN THE MESOSPHERE AND THERMOSPHERE c46
T. Michael Davis *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 27 p refs (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 04A

In an effort to isolate the essential physics of the mesosphere and the thermosphere, a steady one-dimensional density and pressure model has been developed in support of related NASA activities, i.e., projects such as the AOTV and the Space Station. The model incorporates a zeroth order basic state including both the three-dimensional wind field and its associated shear structure, etc. A first order wave field is also incorporated in period bands ranging from about one second to one day. Both basic state and perturbation quantities satsify the combined constraints of mass, linear momentum and energy conservation on the midlatitude beta plane. A numerical (iterative) technique is used to solve for the vertical wind which is coupled to the density and pressure fields. The temperature structure from 1 to 1000 km and the lower boundary conditions are specified using the U.S. Standard Atmosphere 1976. Vertical winds are initialized at the top of the Planetary Boundary Layer using Ekman pumping values over flat terrain. The model also allows for the generation of waves during the geostrophic adjustment process and incorporates wave nonlinearity effects. Author

N86-24521*# Texas A&M Univ., College Station. Dept. of Meteorology.
OBSERVATIONAL AND NUMERICAL STUDIES OF THE LOW-LEVEL JET STREAM IN THE ATMOSPHERE c47
Dusan Djuric *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 21 p refs (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 04B

Two cases of low-level jet (LLJ) support the hypothesis that the LLJ is an integral part of synoptic-scale cyclogenesis. The appearance of an arch with a row of cumulonimbus is discovered at the front of the LLJ. The inertia oscillations in the LLJ are pointed out as part of the quasi-diurnal variation. A plan for further research by numerical modelling is proposed, which will bring more clarification of the mechanics of the LLJ. Author

N86-24522*# Embry-Riddle Aeronautical Univ., Daytona Beach, Fla. Dept. of Aeronautical Engineering.
PRELIMINARY DESIGN METHODS FOR FIBER REINFORCED COMPOSITE STRUCTURES EMPLOYING A PERSONAL COMPUTER c24
Charles N. Eastlake *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 27 p refs (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 11D

The objective of this project was to develop a user-friendly interactive computer program to be used as an analytical tool by structural designers. Its intent was to do preliminary, approximate stress analysis to help select or verify sizing choices for composite structural members. The approach to the project was to provide a subroutine which uses classical lamination theory to predict an effective elastic modulus for a laminate of arbitrary material and ply orientation. This effective elastic modulus can then be used in a family of other subroutines which employ the familiar basic structural analysis methods for isotropic materials. This method is simple and convenient to use but only approximate, as is appropriate for a preliminary design tool which will be subsequently verified by more sophisticated analysis. Additional subroutines have been provided to calculate laminate coefficient of thermal expansion and to calculate ply-by-ply strains within a laminate. Author

N86-24523*# John Brown Univ., Siloam Springs, Ark. Dept. of Mechanical Engineering.
A PHOENICS MODEL FOR THE TRIAXIAL LOADING OF AN INITIALLY CYLINDRICAL MASS OF RATE-TYPE MATERIAL WITH PROVISIONS FOR BULGING AND YIELD c39
kenneth W. French, Jr. *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 20 p refs (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 20K

This work traces the response of a granular material via the Ten Coefficient Truesdell rate-type constituitive model into the simplest meaningful loading: the triaxial test configuration. A functional relation has been posed for computing the rather peculiar relation between average applied stress and average porosity. Using that relation an attack has been mounted on the dilemma that exists between dynamic and constitutive use of the pressure variable; that is relating dynamic pressure, thermodynamic pressure, stress deviator and higher stress invariants. The resolution was as a linear superposition with a one-way feedback, in that while the dynamic component could not effect the constituitive component, the converse was not true since density appears in the momentum transport relation. Author

N86-24524*# Tennessee Univ., Knoxville. Dept. of Mechanical and Aerospace Engineering.
INVESTIGATION AND MODELING OF SPACE SHUTTLE MAIN ENGINE SHUTDOWN TRANSIENT CHUGGING c20
Paul E. George, II *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 18 p (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 21H

The space shuttle main engines experience a low frequency pressure pulsation in both the fuel and oxidizer preburners during the shutdown transient. This pressure pulsation, called chugging, has been linked to undesirable bearing loads and possible damage to the spark ignitor supply piping for the fuel preburner. The problem is briefly described and a model is proposed that includes: (1) a transient stirred tank reactor model for the combustion chamber, (2) a resistance capacitance model for the supply piping and (3) purge gas/liquid oxygen interface tracking. Author

N86-24525*# Oakwood Coll., Huntsville, Ala. Dept. of Systems Software.
A STUDY OF THE VERY HIGH ORDER NATURAL USER LANGUAGE (WITH AI CAPABILITIES) FOR THE NASA SPACE STATION COMMON MODULE c61
Esther N. Gill *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 36 p refs (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 09B

The requirements are identified for a very high order natural language to be used by crew members on board the Space Station. The hardware facilities, databases, realtime processes, and software support are discussed. The operations and capabilities that will be required in both normal (routine) and abnormal (nonroutine) situations are evaluated. A structure and syntax for

an interface (front-end) language to satisfy the above requirements are recommended. Author

N86-24526*# Jackson State Univ., Miss.
APPLICATION OF WEIBULL ANALYSIS TO SSME HARDWARE **c38**
Lou Allen Bell Gray *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 25 p refs (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 14D

Generally, it has been documented that the wearing of engine parts forms a failure distribution which can be approximated by a function developed by Weibull. The purpose here is to examine to what extent the Weibull distribution approximates failure data for designated engine parts of the Space Shuttle Main Engine (SSME). The current testing certification requirements will be examined in order to establish confidence levels. An examination of the failure history of SSME parts/assemblies (turbine blades, main combustion chamber, or high pressure fuel pump first stage impellers) which are limited in usage by time or starts will be done by using updated Weibull techniques. Efforts will be made by the investigator to predict failure trends by using Weibull techniques for SSME parts (turbine temperature sensors, chamber pressure transducers, actuators, and controllers) which are not severely limited by time or starts. Author

N86-24527*# Mississippi State Univ., Mississippi State. Dept. of Chemical Engineering.
STANDARDIZATION OF CARBON-PHENOLIC COMPOSITE TEST METHODOLOGY **c54**
William B. Hall *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 27 p (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 11D

The objective of this study was to evaluate the residual volatiles, filler content, and resin flow test procedures for carbon-phenolic prepreg materials. The residual volatile test procedure was rewritten with tighter procedure control which was then evaluated by round robin testing by four laboratories on the same rolls of prepreg. Results indicated that the residual volatiles test was too operator and equipment dependent to be reliable, and it was recommended that the test be discontinued. The resin flow test procedures were rewritten with tighter procedure control, and it is now considered to be an acceptable test. It was recommended that the filler content determination be made prior to prepregging. Author

N86-24528*# University of Southern Mississippi, Hattiesburg. Dept. of Engineering Technology.
AUTOMATION OF ELECTROMAGNETIC COMPATABILITY (EMC) TEST FACILITIES **c32**
Cecil A. Harrison *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 17 p refs (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 20N

Efforts to automate electromagnetic compatibility (EMC) test facilities at Marshall Space Flight Center are discussed. The present facility is used to accomplish a battery of nine standard tests (with limited variations) deigned to certify EMC of Shuttle payload equipment. Prior to this project, some EMC tests were partially automated, but others were performed manually. Software was developed to integrate all testing by means of a desk-top computer-controller. Near real-time data reduction and onboard graphics capabilities permit immediate assessment of test results. Provisions for disk storage of test data permit computer production of the test engineer's certification report. Software flexibility permits variation in the tests procedure, the ability to examine more closely those frequency bands which indicate compatibility problems, and the capability to incorporate additional test procedures. Author

N86-24529*# Alabama Univ., Huntsville. Dept. of Electrical and Computer Engineering.
MODELING AND ANALYSIS OF CASCADE SOLAR CELLS **c44**
Fat Duen Ho *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 23 p refs (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 10A

A brief review is given of the present status of the development of cascade solar cells. It is known that photovoltaic efficiencies can be improved through this development. The designs and calculations of the multijunction cells, however, are quite complicated. The main goal is to find a method which is a compromise between accuracy and simplicity for modeling a cascade solar cell. Three approaches are presently under way, among them (1) equivalent circuit approach, (2) numerical approach, and (3) analytical approach. Here, the first and the second approaches are discussed. The equivalent circuit approach using SPICE (Simulation Program, Integrated Circuit Emphasis) to the cascade cells and the cascade-cell array is highlighted. The methods of extracting parameters for modeling are discussed. Author

N86-24530*# Alabama Univ., Tuscaloosa. Dept. of Mathematics.
A METHOD FOR LINEARIZING A NONLINEAR SYSTEM WITH SIX STATE VARIABLES AND THREE CONTROL VARIABLES **c64**
Wei-Shen Hsia *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 25 p ref (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 12A

A nonlinear system governed by $x = f(x,u)$ with six state variables and three control variables is considered in this project. A set of transformations from (x,u) - space to (z,v) - space is defined such that the linear tangent model is independent of the operating point in the z-space. Therefore, it is possible to design a control law satisfying all operating points in the transformed space. An algorithm to construct the above transformations and to obtain the associated linearized system is described in this report. This method is applied to a rigid body using pole placement for the control law. Results are verified by numerical simulation. Closed loop poles in x-space using traditional local linearization are compared with those pole placements in the z-space. Author

N86-24531*# Auburn Research Foundation, Inc., Ala. Dept. of Mechanical and Materials Engineering.
ON THE DETERMINATION OF THE ORIGIN OF LINEAR ANOMALY IN THE MACROSTRUCTURE OF VPPA WELDED 2219-T87 ALUMINUM ALLOY **c26**
Wartan A. Jemian *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 30 p refs (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 11F

The objective was to determine the cause and significance of the weld radiograph enigma, which is a linear anomaly in the features of the X-ray film. By observing features on available radiographs and in studying published reports of similar features it was possible to conclude that there are many manifestations of the enigma, and that they are all specific features of fine structure in radiographs due to natural processes connected with welding and to specific X-ray absorption and diffraction phenomena. These processes include the thermal distribution and liquid metal flow in welding, the development of microstructure, morpohology, second phase particles and porosity due to the solidification process and to the pattern of residual stresses after the weld metal has cooled to the ambient temperature. Microdensitometer traces were made across weld radiographs of standard and enigmatic types. Similar patterns were produced by computer simulation. These show that the enigma is a relatively low contrast feature compared to real weld defects, such as undercuts or centerline cracks. The enigma can be distinguished from weld defects by these microdensitometer

traces. The enigma effect on weld properties is not known but is expected to be minor. Author

N86-24532*# Huntingdon Coll., Montgomery, Ala. Dept. of Chemistry.
ELECTROCHEMICAL CORROSION STUDIES c26
Ward W. Knockemus *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 19 p refs (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 11F

The objective was to gain familiarity with the Model 350 Corrosion Measurement Console, to determine if metal protection by grease coatings can be measured by the polarization-resistance method, and to compare corrosion rates of 4130 steel coated with various greases. Results show that grease protection of steel may be determined electrochemically. Studies were also conducted to determine the effectiveness of certain corrosion inhibitors on aluminum and steel. Author

N86-24533*# New Mexico State Univ., University Park. Dept. of Mathematical Sciences.
ANALYSIS OF HIGH-ORDER LANGUAGES FOR USE ON SPACE STATION APPLICATION SOFTWARE c61
Arthur Knoebel *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 20 p refs (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 09B

Considered in this study is the general and not easily resolved problem of how to choose the right programming language for a particular task. This is specialized to the question of which versions of what languages should be chosen for the multitude of tasks that the Marshall Space Flight Center will be responsible for in the Space Station. Four criteria are presented: theoretical considerations, quantitative matrices, qualitative benchmarks, and the monitoring of programmers. Specific recommendations for future studies are given to resolve these questions for the Space Station. Author

N86-24534*# Oregon Univ., Eugene. Dept. of Chemistry.
INVESTIGATIONS OF TOUGHENING MECHANISMS OF EPOXY RESINS c27
T. Koenig *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 22 p refs (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 11B

Composite material technology was applied to the solid rocket booster by the development of a carbon filament-epoxy resin case which yields a net increase of 4000 lbs. in payload in the shuttle. The question of reusability of the new composite tanks has not yet been answered and will depend on the toughness of the matrix resin. The present study was aimed at providing conditions whereby test specimens of the epoxy resin (EPON/85) and curing agents of systematically varied structures could be produced in a controlled manner. Three sets of conditions were found that might allow the isolation of the structural effects on toughness from the cure effects. The kinetic methods leading to the determination of these conditions are described. Author

N86-24535*# Alabama Univ., Huntsville. Dept. of Mechanical Engineering.
ANALYTICAL DETERMINATION OF SPACE STATION RESPONSE TO CREW MOTION AND DESIGN OF SUSPENSION SYSTEM FOR MICROGRAVITY EXPERIMENTS c18
Frank C. Liu *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 36 p (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04

The objective of this investigation is to make analytical determination of the acceleration produced by crew motion in an orbiting space station and define design parameters for the suspension system of microgravity experiments. A simple structural model for simulation of the IOC space station is proposed. Mathematical formulation of this model provides the engineers a simple and direct tool for designing an effective suspension system. Author

N86-24536*# Alabama Univ., Birmingham. Dept. of Computer and Information Science.
MACHINE VISION AND THE OMV c61
Michael A. McAnulty *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 24 p refs (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 09B

The orbital Maneuvering Vehicle (OMV) is intended to close with orbiting targets for relocation or servicing. It will be controlled via video signals and thruster activation based upon Earth or space station directives. A human operator is squarely in the middle of the control loop for close work. Without directly addressing future, more autonomous versions of a remote servicer, several techniques that will doubtless be important in a future increase of autonomy also have some direct application to the current situation, particularly in the area of image enhancement and predictive analysis. Several techniques are presentet, and some few have been implemented, which support a machine vision capability proposed to be adequate for detection, recognition, and tracking. Once feasibly implemented, they must then be further modified to operate together in real time. This may be achieved by two courses, the use of an array processor and some initial steps toward data reduction. The methodology or adapting to a vector architecture is discussed in preliminary form, and a highly tentative rationale for data reduction at the front end is also discussed. As a by-product, a working implementation of the most advanced graphic display technique, ray-casting, is described. Author

N86-24537*# Berry Coll., Mount Berry, Ga. Dept. of Physics.
A STUDY OF 35-GHZ RADAR-ASSISTED ORBITAL MANEUVERING VEHICLE/SPACE TELESCOPE DOCKING c18
Malcolm W. McDonald *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 31 p refs (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 22A

An experiment was conducted to study the effects of measuring range and range rate information from a complex radar target (a one-third scale model of the Edwin P. Hubble Space Telescope). The radar ranging system was a 35-GHz frequency-modulated continuous wave unit developed in the Communication Systems Branch of the Information and Electronic Systems Laboratory at Marshall Space Flight Cneter. Measurements were made over radar-to-target distances of 5 meters to 15 meters to simulate the close distance realized in the final stages of space vehicle docking. The Space Telescope model target was driven by an antenna positioner through a range of azimuth and elevation (pitch) angles to present a variety of visual aspects of the aft end to the radar. Measurements were obtained with and without a cube corner reflector mounted in the center of the aft end of the model. The results indicate that range and range rate measurements are performed significantly more accurately with the cooperative radar reflector affixed. The results further reveal that range rate (velocity) can be measured accurately enough to support the required soft docking with the Space Telescope. Author

N86-24538*# Athens Coll., Ala. Dept. of Chemistry.
DIELECTRIC CURE MONITORING OF THE 55A FILAMENT WOUND CASE RESIN c27
Ronald C. McNutt *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 27 p refs (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 11B

Studies were conducted to correlate data from dielectric cure monitoring of 55A filament would case resins using the Micromet

System II with differential scanning calorimetry and resin strength tests. Strength tests for resin bonding at various time intervals and DSC are standard accepted techniques for monitoriong resin cure cycles. They are time consuming, destructive, and non-continuous. The Micromet System II will yield reliable information on degree of cure and other parameters, which should allow better quality control on filament wound case resin cure. Author

N86-24539*# Naval Postgraduate School, Monterey, Calif. Dept. of Physics.
RADIATIVELY DRIVEN WINDS FROM MAGNETIC, FAST-ROTATING STARS c90
Steven Nerney *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 16 p refs (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 03B

An analytical procedure is developed to solve the magnetohydrodynamic equations for the stellar wind problem in the strong-magnetic field, optically thick limit for hot stars. The slow-mode, Alfven, and fast-mode critical points are modified by the radiation terms in the force equation but in a manner that can be treated relatively easily. Once the velocities at the critical points and the distances to the points are known, the streamline constants are determined in a straight-forward manner. This allows the structure of the wind to be elucidated without recourse to complicated computational schemes. Author

N86-24540*# Claflin Coll., Orangeburg, S.C. Dept. of Mathematics, Physics and Computer Science.
INVESTIGATION OF LOW-TEMPERATURE SEMICONDUCTOR DEVICES c76
D. R. Overcash *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 11 p refs (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 20L

The objectives of this investigation were to determine the characteristics of semiconductor devices at low temperatures. The output characteristics of several currently available semiconductor devices and devices fabricated at Marshall Space Flight Center were measured over a range of gate voltages. Large variations in low-temperature performance, not only from type to type, but from field effect transistor (FET) to FET of the same type were obtained. By increasing the carrier concentrations at low temperatures through extra heavy doping, metal oxide semiconductor field effect transistor (MOSFET) device was fabricated that operated at 4.2K. To verify the low-temperature operation of a heavily doped device, this procedure was repeated. Their noise spectrum was analyzed at 4.2K. Suggestions were made as to possible fabrication methods, techniques, and other semiconductor materials that might improve the device charactersitics at low temperatures. A procedure for using an electric field to drift dopants through the insulating oxide to produce a very thin, heavily doped region under the gate of a MOSFET was initiated. Capacitance as a function of voltage plots was suggested as a method for determining the level of dopant drift. Author

N86-24541*# Tennessee Technological Univ., Cookeville. Dept. of Mathematics and Computer Science.
RELIABILITY MODELS APPLICABLE TO SPACE TELESCOPE SOLAR ARRAY ASSEMBLY SYSTEM c89
S. A. Patil *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 26 p refs (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 03A

A complex system may consist of a number of subsystems with several components in series, parallel, or combination of both series and parallel. In order to predict how well the system will perform, it is necessary to know the reliabilities of the subsystems and the reliability of the whole system. The objective of the present study is to develop mathematical models of the reliability which are applicable to complex systems. The models are determined by assuming k failures out of n components in a subsystem. By taking $k = 1$ and $k = n$, these models reduce to parallel and series models; hence, the models can be specialized to parallel, series combination systems. The models are developed by assuming the failure rates of the components as functions of time and as such, can be applied to processes with or without aging effects. The reliability models are further specialized to Space Telescope Solar Arrray (STSA) System. The STSA consists of 20 identical solar panel assemblies (SPA's). The reliabilities of the SPA's are determined by the reliabilities of solar cell strings, interconnects, and diodes. The estimates of the reliability of the system for one to five years are calculated by using the reliability estimates of solar cells and interconnects given n ESA documents. Aging effects in relation to breaks in interconnects are discussed. Author

N86-24542*# Memphis State Univ., Tenn. Dept. of Mechanical Engineering.
TURBULENT FLOW FIELD PREDICTIONS IN SHARPLY CURVED TURN AROUND DUCTS c34
L. Michael Santi *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 38 p refs (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 20D

In this investigation, two-dimensional turbulent flow of incompressible Newtonian fluids in sharply curved 180 deg turn around ducts is studied. Results of an approximate numerical flow field analysis utilizing an orthogonal, body-fitted, curvilinear coordinate system are compared to results based on a traditional cylindrical reference frame. Qualitative indication of general streamfield characteristics as well as quantitative benchmarks for the planning of future experimentation are provided. In addition, preliminary results of an augmented kappa-epsilon turbulence model analysis, which explicitly accounts for the effects of streamline curvature and pressure strain in internal turbulent flows, are presented. Specific model difficulties are discussed and comparisons with standard kappa-esilon model predictions are included. Author

N86-24543*# Alabama Univ., Huntsville. Dept. of Mathematics.
MISSION ANALYSIS FLOW SEQUENCING OPTIMIZATION c66
McKinley Scott *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 14 p refs (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 12B

This investigation is an extension of a project dealing with the problem of optimal use of ground resources for future space missions. This problem was formulated as a linear programming problem using an indirect approach. Instead of minimizing the inventory level of needed ground resources, the overlapping periods during which the same types of resources are used by various flights are minimized. The model was built upon the assumption that during the time interval under consideration, the costs of various needed resources remain constant. Under other assumptions concerning costs of resources, the objective function, in general, assumes a non-linear form. In this study, one case where the form of the objective function turns out to be quadratic is considered. Also, disadvantages and limitations of the approach used are briefly discussed. Author

N86-24544*# Calhoun Community Coll., Decatur, Ala.
SIMULATION AND STUDY OF SMALL NUMBERS OF RANDOM EVENTS c65
Russell D. Shelton *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 20 p (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 12A

Random events were simulated by computer and subjected to various statistical methods to extract important parameters. Various forms of curve fitting were explored, such as least squares, least distance from a line, maximum likelihood. Problems considered were dead time, exponential decay, and spectrum extraction from

cosmic ray data using binned data and data from individual events. Computer programs, mostly of an iterative nature, were developed to do these simulations and extractions and are partially listed as appendices. The mathematical basis for the compuer programs is given. Author

N86-24545*# California Univ., San Diego. Center for Astrophysics and Space Science.
AUTOMATED CALIBRATION OF A FLIGHT PARTICLE SPECTROMETER c35
Roy B. Torbert *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 18 p (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 14B

A system for calibrating both electron and ion imaging particle spectrometers was devised to calibrate flight instruments in a large vacuum facility in the Space Science Laboratory at the Marshall Space Flight Center. An IBM-compatible computer was used to control, via an IEEE 488 buss protocol, a two-axis gimbled table, constructed to fit inside the tank. Test settings of various diagnostic voltages were also acquired via the buss. These spectrometers constructed by the author at UCSD were calibrated in an automatic procedure programmed on the small computer. Data was up-loaded to the SSL VAX where a program was developed to plot the results. Author

N86-24546*# Lambuth Coll., Jackson, Tenn. Dept. of Physics, Mathematics and Computer Science.
A PRELIMINARY STUDY OF FLAT-PANEL DISPLAYS c53
Kenneth E. Yancey *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 16 p refs (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 09C

Six display technologies that might be of future value in a spacelab workstation are discussed. Some have been developed to the point where they could be used as a computer display while others have not. The display technologies studied are electroluminescents, light-emitting didodes, gas plasma, liquid crystal, electrochromic, and electrophoretic. An explanation of each mechanism is provided along with the state-of-the-art development. Author

N86-24547*# Alabama Univ., Birmingham. Dept. of Physics.
SOME ENERGY CONSIDERATIONS IN GAMMA RAY BURST LOCATION DETERMINATIONS BY AN ANISOTROPIC ARRAY OF DETECTORS c43
John H. Young *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 27 p refs (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 03B

The anisotropic array of detectors to be used in the Burst and Transient Experiment (BATSE) for locating gamma ray burst sources is examined with respect to its ability to locate those sources by means of the relative response of its eight detectors. It was shown that the energy-dependent attenuation effects of the aluminum window covering each detector has a significant effect on source location determinations. Location formulas were derived as a function of detector counts and gamma ray energies in the range 50 to 150 keV. Deviation formulas were derived and serve to indicate the location error that would be caused by ignoring the influence of the passive absorber. Author

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N86-24548# Department of the Air Force, Washington, D.C.
GIVING A NEW FOCUS TO RESOURCE MANAGEMENT
Donald C. Prettol 1985 9 p Presented at the 19th Annual Department of Defense Cost Analysis Symposium, Leesburg, Va., 17-20 Sep. 1985
(AD-A161840) Avail: NTIS HC A02/MF A01 CSCL 05/1

In Army resource management, for the past several years a management anarchronism has been perpetuated. The move through the Planning, Programming, Budget and Execution System (PPBES) process, is not accompanied by the continuity necessary to find out how well decisions in the earlier phases of the process actually turn out. This key management process has been allowed to exist without any formal, systematic feedback loop--the key step necessary to evaluate the quality of decisions and to improve the quality of future decision making. In the planning phase of the management process, is developed The Army Plan by function. Over all priorities are established and decisions made for the future in terms of those functions and their relationship to the overall goals of the Army's leadership for the next five and following ten years. In the programming phase of the process, resources are programmed o support specific missions and initiatives within each of the functions--identifying first the action required to support the plan for each of the functions, then the resources necessary to accomplish these missions. GRA

N86-24549# Naval Ocean Systems Center, San Diego, Calif.
THE TECHNICAL ASSISTANCE PROGRAM: A PROGRAM PLAN Final Report, Sep. 1984 - Jul. 1985
R. November Sep. 1985 118 p
(Z08-35)
(AD-A161893; NOSC/TD-832) Avail: NTIS HC A06/MF A01 CSCL 05/1

The Technical Assistance Program (TAP) is authorized by Public Law 96-480 of 21 October 1980, known as the Stevenson-Wydler Technology Innovation Act of 1980. Functions include: to provide and disseminate information on federally owned or originated products, processes, and services having potential application to state and local governments and to private industry, and to provide technical assistance in response to requests from state and Government officials. It encourages the establishment of technical volunteer programs as a resource to complement and support domestic technology transfer activities. The TAP will use retirees and current employees to translate the products of the Naval Ocean System Center to state and local governments and to the private sector in a broker capacity. They will act as a transfer agent, on donated time, to match the requirements necessary to respond to technology transfer requests received. This report is provided as a guide on how to establish a TAP. All examples and forms are based on NAVOCEANSYSCEN instructions. Any Federal laboratory may adopt the program by simply revising the plan to suit their organization. GRA

N86-24550# Mitre Corp., Bedford, Mass.
AIR FORCE GEOPHYSICS LABORATORY MANAGEMENT INFORMATION SYSTEM DEVELOPMENT PLAN Final Report
Alice A. Hayen and C. K. Reid Aug. 1985 53 p
(Contract F19628-84-C-0001)
(AD-A162005; MTR-9528; ESD-TR-85-134) Avail: NTIS HC A04/MF A01 CSCL 09/2

As part of a plan to modernize operations and services, the Air Force Geophysics Laboratory (AFGL) is implementing a management information system (MIS) for AFGL top- and middle-level managers. This document specifies the plan and schedule for implementation of the AFGL MIS. The approach to the MIS implementation, system architecture, and functions of the previously defined implementable subsystems are stated. Tasks are identified and scheduled. GRA

N86-24551# Carnegie-Mellon Univ., Pittsburgh, Pa. Robotics Inst.
REPRESENTATION OF ACTIVITY KNOWLEDGE FOR PROJECT MANAGEMENT Interim Technical Report
Arvind Sathi, Mark S. Fox, and Mike Greenberg Sep. 1985 62 p Submitted for publication
(AD-A162309; CMU-RI-TR-85-17) Avail: NTIS HC A04/MF A01

CSCL 05/1

Representation of activity knowledge is important to any application which must reason about activities, such as new product management, factory scheduling, robot control, vehicle control, software engineering and air traffic control. This article provides an integration of the underlying theories needed for modeling activities. Using the domain of large computer design projects as example, the semantics of activity modeling is described. While past research in Knowledge Representation has discovered most of the underlying concepts, our attempt is towards their integration. This includes the epistemological concepts for erecting the required knowledge structure; the concepts of Activity, State, Goal and Manifestation for the adequate description of the plan and the progress; and the concepts of Time and Causality to infer the progression among the activities. We also address the issues which arise due to the integration of aggregation, time and causality among activities and states. GRA

N86-24552# Naval Postgraduate School, Monterey, Calif.
MICROCOMPUTER-BASED DETACHMENT ADMINISTRATIVE MANAGEMENT SYSTEM FOR THE LAMPS (LIGHT AIRBORNE MULTI-PURPOSE SYSTEM) COMMUNITY. A REQUIREMENTS ANALYSIS M.S. Thesis
Gregory F. Smith Sep. 1985 157 p
(AD-A162366) Avail: NTIS HC A08/MF A01 CSCL 09/2

This thesis presents a requirements analysis of a microcomputer based system to be used by sea-going Light Airborne Multipurpose System (LAMPS) detachment for administrative data management and recurring reports generation. Included are the results of user interviews which were conducted to determine possible system functions. These functions, through analysis, are presented in a hierarchical charting with data flow diagrams and accompanying processing narratives. System data is then presented in data dictionary format. Recommendations are made as to possible system implementation and design. GRA

N86-24553# Analytics, Inc., Dayton, Ohio.
DETERMINING THE COST OF ACQUISITION DATA PACKAGES Final Report, 4 Sep. 1984 - 28 Jun. 1985
Thomas M. McCann and Michael N. Ward 28 Jun. 1985 87 p
(Contract F33615-84-C-5077)
(AD-A163001; Rept-1958-TR-04; BRMC-84-5077) Avail: NTIS HC A05/MF A01 CSCL 05/1

The true cost of data needed for acquisition of spare parts on past and current systems is unknown. Therefore, tradeoff decisions are made which can result in inadequate technical data for competitive acquisition of spare parts. The objective of this research is to develop a methodology for determining the reasonableness of contractor's acquisition data cost proposals. The methodology must be validated and have practical application on a day-to-day basis in the acquisition environment. The ultimate goal of this research effort is to provide DoD acquisition personnel with a tool for determining the reasonableness of contractor acquisition data package proposals. This tool will aid in negotiation in data cost and cost benefit analyses on engineering data for competitive procurement of repairable and nonrepairable spare parts. Successful completion of the task involves integrating both the factors which influence data cost and associated cost information into a methodology which can be used by the PCO or price analyst in the evaluation of contractor proposals. GRA

N86-24554# Horizon Inst. for Advanced Design, Inc., Rockville, Md.
COMPARISON OF SCIENTIFIC AND TECHNICAL PERSONNEL TRENDS IN THE UNITED STATES, FRANCE, WEST GERMANY AND THE UNITED KINGDOM SINCE 1970
J. Mintzes and W. Tash Mar. 1985 253 p
(Grant NSF SRS-82-15756)
(PB86-133030; NSF-84-335) Avail: NTIS HC A12/MF A01 CSCL 05A

Comparative data on the number of natural scientists and engineers showed that in the early 1980's, the United States had 2.6 million natural scientists and engineers in the labor force compared with 621 thousand for West Germany, 633 thousand for France, and 592 thousand for the United Kingdom. Although the United States has more natural scientists and engineers in the labor force than these three countries combined, the U.S. proportion of natural scientists and engineers in the labor force in the early 1980's was about the same as that of other countries. It is agreed that scientists and engineers in the United States demonstrate a higher degree of mobility (geographic and occupational) than do their counterparts in the European countries. Engineers in France and West Germany more frequently move into top management positions than do those in the United States and the United Kingdom. Less attention is given in the United States to the systematic training of technicians and establishment of standards than in the European countries. Updating of skills of scientists and engineers is also more systematic in the European countries than in the United States with special tax-supported programs, notably in France. In the United States, larger firms often carry out such training for their staff and, more often than in Europe, it is up to the individuals. GRA

N86-24555# Michigan Univ., Ann Arbor. Graduate School of Business Administration.
SURVEY OF THE LITERATURE ON PRODUCTION SCHEDULING AS IT PERTAINS TO FLEXIBLE MANUFACTURING SYSTEMS
N. Raman Aug. 1985 89 p Sponsored in part by National Bureau of Standards, Gaithersburg, Md.
(PB86-106754; NBS/GCR-85/499) Avail: NTIS HC A05/MF A01 CSCL 13H

A survey of the existing literature on machine scheduling from the perspective flexible manufacturing systems is presented. It is the first of a series of papers planned to document research in scheduling for the Automated Manufacturing Research Facility (AMRF) at the National Bureau of Standards. An overview of the hierarchical production planning process is given. Deterministic, non-preemptive scheduling of open shops are covered, since a typical flexible manufacturing system (FMS) operates under these conditions. Both due-date based and flow-time based objectives are addressed for single stage single machine, single stage parallel machines, flow shops and job shops. Research in assembly line balancing is similarly covered since it is possible to treat an FMS as a transfer line for repetitive discrete manufacture. The analytical approaches to these problems have focussed primarily on the objectives of maximizing production rate, minimizing in-process inventory, and maximizing machine utilization. GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software.*

N86-24556 Texas Univ., Austin.
A SELF-ORGANIZING RETRIEVAL SYSTEM FOR GRAPHS Ph.D. Thesis
Robert Arlen Levinson 1985 101 p
Avail: Univ. Microfilms Order No. DA8527601

The theory, design, and implementation of a graph-based, self-organizing database retrieval system. The system is designed to support the expert problem solving tasks of recall, design, and discovery. The fundamental design principle is the production of a partial ordering by the relation subgraph-of. This reslation is considered to be equivalent to more-general-than. This document discusses this design from 3 different levels: an abstract level in which the nodes in he partial ordering are concepts, the implementation level described above (the nodes are graphs), or an application level in which the nodes are domain specific objects such as molecules or reactions. The primary problem domain explored is organic chemistry. A large database of organic reactions and starting materials can be queried to extract reactions or

molecules that match, either exactly or approximately, desired structures. The system may also suggest precursors to a desired target molecule. The queries are answered by exploiting a set of concepts that are common subgraphs of molecule or reaction graphs. Dissert. Abstr.

N86-24557 Ohio State Univ., Columbus.
ADAPTIVE CONCURRENCY CONTROL FOR DISTRIBUTED DATABASE SYSTEMS Ph.D. Thesis
Amet Pravin Sheth 1985 274 p
Avail: University Microfilms Order No. DA8526249

A distributed database system needs a concurrency control mechanism to maintain consistency of the database in presence of concurrent execution of transactions. While there has been a proliferation of proposed concurrency control mechanisms, there are few studies that compare performance of various mechanisms. A distributed database environment is characterized by four sets of parameters: network parameters, failure parameters, transaction parameters, and database parameters. The two main goals of this research are: (1) evaluate the effect on the performance due to the changes in various parameters, and (2) propose adaptive mechanisms that attempt to minimize the performance degradation in changing environment. the performance is studied in context of relaxing three important assumptions made in most of the earlier research. These assumptions are: (1) Constant transmission time, (2) no failure, and (3) identical transactions. Three adaptive schemes are propsed to deal with the changes in four sets of parameters. Dissert. Abstr.

N86-24558 George Washington Univ., Washington, D.C.
A DESIGN METHODOLOGY FOR ON-LINE MENU-DRIVEN INFORMATION RETRIEVAL SYSTEMS Ph.D. Thesis
Agha Kamal Ghahari 1985 239 p
Avail: Univ. Microfilms Order No. DA8526773

Currently, there are thousands of information specialists, each one handling hundreds of queries per year. All information, if it is available for quick retrieval, has to be held in some sort of database as part of an information system. This thesis investigates a methodology for designing on-line menu-driven information retrieval systems that meet requirements for ease of use and quick response. The dissertation characterizes an interactive user interface based on a menu-driven system. The characterization begins by describing the menu-driven interface and goes on to model the basic menu systems. To address some of the more practical issues the design and implementation of HC Online Information System is discussed: an interactive and menu-based information system with quick response time. The design methodology is applied to HC Online using a hierarchical searching keys concept and inverted file techniques. Dissert. Abstr.

N86-24559# Fachinformationszentrum fuer Energie, Physik, Mathematik G.m.b.H., Karlsruhe (West Germany). Inst. fuer Anorganische Chemie der Univ.
INORGANIC CRYSTAL STRUCTURE DATABASE IN CONJUNCTION WITH CRYSTAL STRUCTURE INFORMATION SYSTEM AND ITS APPLICATION TO CCDF (CAMBRIDGE CRYSTALLOGRAPHIC DATA FILE) AND MDF (METAL DATA FILE)
G. Bergerhoff, B. Kilger, C. Witthauer, R. Hundt, and R. Sievers 1984 56 p
Avail: NTIS HC A04/MF A01

The dialogue oriented system CRYSTIN was developed in order to enable online searches of crystal structure data bases. Commands and descripter classes are summarized. Examples of simple searches are presented. B.G.

N86-24560# Defense Technical Information Center, Alexandria, Va.
GOVERNMENT ACRONYMS AND ALPHABETIC ORGANIZATIONAL DESIGNATIONS USED IN DTIC (DEFENSE TECHNICAL INFORMATION CENTER) Report, Period Ending Oct. 1985
Loretta M. Brown Nov. 1985 274 p Supersedes DTIC/TR-84/5 (AD-A161900; DTIC/TR-85/18; DTIC/TR-84/5) Avail: NTIS HC A12/MF A01 CSCL 05/2

This compilation is a guide to acronyms as assigned by the Defense Technical Information Center (DTIC). The listing contains entries from the Department of Defense (DoD), Federal Government and foreign military organizations. The acronyms reflect reports processed into the DTIC collections. In all instances the acronyms are those actually use by the organization itself. GRA

N86-24561# Mitre Corp., Bedford, Mass.
AIR FORCE GEOPHYSICS LABORATORY MANAGEMENT INFORMATION SYSTEM STUDY Final Report
Alice A. Hayen Nov. 1985 40 p
(Contract F19628-84-C-0001)
(AD-A161910; MTR-9338; ESD-TR-85-114) Avail: NTIS HC A03/MF A01 CSCL 05/1

MITRE has conducted a study to define the management information needs of Air Force Geophysics Laboratory (AFGL) managers and to investigate alternative approaches forthe implementation of a management information system (MIS) at AFGL. The study summarizes current management and administrative practices at AFGL. Requirements have been identified for automating several currently manual functions to compile accurate and timely information to better manage and plan AFGL programs. This document describes the functions and relative priorities of five MIS subsystems and provides suggestions for implementation solutions. Creation of a detailed Development Plan is recommended as the follow-on task. Author (GRA)

N86-24562# DOD Security Review Commission, Washington, D.C.
KEEPING THE NATION'S SECRETS: A REPORT TO THE SECRETARY OF DEFENSE BY THE COMMISSION TO REVIEW DoD SECURITY POLICIES AND PRACTICES Final Report
Richard G. Stilwell 19 Nov. 1985 121 p
(AD-A161998) Avail: NTIS HC A06/MF A01 CSCL 05/1

The report contains an introduction, executive summary, overview and a three part report with sixty-three recommendations for change in DoD security policies and procedures related to the protection of classified material. Policy and Procedures, the first section of the report's main body, includes classified information access (clearances, investigations, adjudication, cryptographic controls, personnel supervisory evaluations and personnel information collection), managing and controlling classified information (classification, dissemination, transmission, retention and storage, special access program and international transfer agreements), and detecting anc countering hostile intelligence, security awareness, reporting of possible espionage, and detecting and investigating security violators). Management and execution, the second part of the report, includes command emphasis, organizational arrangements, research, training, career development and program oversight. Resource management is the third and final section of the report. GRA

N86-24563# Defense Technical Information Center, Alexandria, Va. Office of Information Systems and Technology.
CURRENT DOCUMENT HANDLING PROCEDURES AT DEFENSE TECHNICAL INFORMATION CENTER Final Report
R. L. Bixby Nov. 1985 97 p
(AD-A162000; DTIC/TR-85/19) Avail: NTIS HC A05/MF A01 CSCL 05/2

The Defense Technical Information Center (DTIC) is responsible for the collection control, and dissemination of scientific and technical information for the Defense community. Thousands of technical reports enter DTIC each year, and thousands of reproductions are distributed to DTIC's users. The processing of these reports is a complicated procedure, involving many steps and decisions. This paper tracks the document handling process that was in effect as of 1 September 1985, and comments on areas which could be improved. GRA

N86-24564# Iowa Univ., Iowa City. Applied-Optimal Design Lab.
DATABASE DESIGN METHODOLOGY AND DATABASE MANAGEMENT SYSTEM FOR COMPUTER-AIDED STRUCTURAL DESIGN OPTIMIZATION Interim Technical Report, Jul. - Dec.

1984
T. S. Murthy and J. S. Arora Dec. 1984 144 p
(Grant AF-AFOSR-0322-82)
(AD-A162101; CAD-SS-84-20; AFOSR-85-1071TR) Avail: NTIS HC A07/MF A01 CSCL 05/1

A study is made to integrate finite element-based-optimal structural design methods and computer-science methods into a computer-based system containing a data base, a program library and man-machine communication link. Emphasis is placed upon database management concepts for structural design. Important components required to build a computer-aided structural design system are described. A number of data base management concepts -- hierarchical, network and relational data models, conceptual, internal and external and external view of data organization, normalization of data, and integrity of data base are discussed with reference to structural design data. A methodology to design a data base are discussed with reference to structural design data. A methodology to design a database is proposed. Three levels of data organization-conceptual, internal and external are suggested. A methodology to construct a numerical data model is described. A numerical data model supports data of various types of large matrices such as banded, skyline and hyper matrices. Requirements of data base management system and components needed to develop it are discussed. GRA

N86-24565# Naval Postgraduate School, Monterey, Calif.
EVALUATION OF A DATA DICTIONARY DURING APPLICATION PROGRAM DESIGN BASED UPON THE FOCUS DBMS (DATA BASE MANAGEMENT SYSTEM) M.S. Thesis
Robert C. Repp Sep. 1985 124 p
(AD-A162117) Avail: NTIS HC A06/MF A01 CSCL 09/2

This thesis considers the design and uses of a data dictionary within the FOCUS DBMS package. The thesis details the background and design considerations of an application program for the Director of Admissions at the Naval Postgraduate School. The program will aid in the assignment of an Academic Profile Code for newly commissioned Naval Officers. A data dictionary is designed and implemented, and its use during application program development is discussed. Features from commercial DBMSs, fourth generation languages, and data dictionaries are compared and their impact on information systems considered. Author (GRA)

N86-24566# Naval Postgraduate School, Monterey, Calif.
DATA DICTIONARY/DIRECTORY SYSTEMS A TOOL IN SYSTEMS DEVELOPMENT LIFE CYCLE M.S. Thesis
Christos Drakoulis Sep. 1985 101 p
(AD-A162182) Avail: NTIS HC A06/MF A01 CSCL 05/1

Although data resources have some characteristics with other corporate resources, such as people, goods or money, they do not have two specific characteristics. They are not relatively scarce, neither are they inherently allocatable. However, they do have value, both positive or negative. The value is derived from the fact that the entire enterprise depends on their availability for the proper management of all the other resources. Organizations are now beginning to treat data as a resource, which requires the same degree of administration and control as is involved in the management of other resources. A key component in this management and control is the Data Dictionary/Directory System. It is a useful tool, throughout a System Development Life Cycle. GRA

N86-24567# Defense Communications Agency, Washington, D.C. Technical and Management Information Center.
USING ONLINE DATABASES TO DETERMINE THE CORRELATION BETWEEN RANKED LISTS OF JOURNALS Final Report, 1 Jul. - 30 Dec. 1984
Donald A. Guerriero 30 Dec. 1984 25 p
(AD-A162202) Avail: NTIS HC A02/MF A01 CSCL 09/2

This research showed the feasibility of using online databases to help librarians in the selection of journals for the Defense Communications Agency. The purpose of the study was to use citation analysis and statistical testing in journal selection. Bibliographic databases, available to most technical libraries, were used in the research. Development of a selection policy for journals requires authoritative evidence from several sources to justify the cost of the journals selected. The results of the research implied that the procedure may be useful in developing journal selection policies for the Defense Communications Agency. GRA

N86-24568# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
A MODIFICATION TO THE COMPUTER GENERATED ACQUISITION DOCUMENTS SYSTEM (CGADS) FOR MICROCOMPUTER USE IN A PROGRAM OFFICE ENVIRONMENT M.S. Thesis
Lynn M. Zabker and Karen M. Zimmerman Sep. 1985 379 p
(AD-A162273; AFIT/GSM/LSY/85S-33) Avail: NTIS HC A17/MF A01 CSCL 09/2

The Computer Generated Acquisition Documents System (CGADS) was designed to assist the program manager (PM) in developing acquisition documents including Statements of Work (SOWs) and Contract Data Requirements Lists (CDRLs) for all phases of the acquisition cycle. CGADS will produce draft versions of these documents which must then be tailored to meet the needs of the particular program. The current CGADS has several shortfalls. PMs outside of ESD have difficulty accessing the system. The system must also be maintained on a mainframe computer since it requires too much disk space to be adapted to a micro-computer. Finally, the output obtained from CGADS is not in the Work Breakdown Structure (WBS) format required by the military handbook on SOW preparation. The main objective of this research was to simplify the PM's job in writing a Full-Scale Development (FSD) SOW/CDRL. This was accomplished by developing a system called Micro-Computer Generated Acquisition Documents Systems or MGADS. The MGADS program was written in COBOL of an MSDOS operating system on a Zenith Z-100 micro-computer. MGADS was developed to overcome the shortfalls of CGADS. Attention was focused only on the FSD SOW/CDRL to allow the program to fit onto a micro-computer. This also eliminates the problem of having to access CGADS over modem/telephones lines. The ouput of MGADS was restructed into WBS format in accordance with the current military handbook. MGADS is an interactive system used to develop a draft version of the FSD SOW/CDRL. GRA

N86-24569# Naval Postgraduate School, Monterey, Calif.
FUNCTIONAL MANAGERS GUIDE TO INFORMATION SYSTEMS DEVELOPMENT M.S. Thesis
William B. Shaner Sep. 1985 145 p
(AD-A162367) Avail: NTIS HC A07/MF A01 CSCL 09/2

The development of large integrated information systems has had a spotty success record. This thesis investigates the role of the user-management team in the development of these systems and what principal problems the organization must face. The study recommends that the user is the individual with ultimate responsibility for the development of the system. Further the problems that must be faced, in descending order of importance, are: (1) the organization power structure, (2) the people in the organization and (3) the technical issues of data processing. GRA

N86-24570# Air Force Office of Scientific Research, Bolling AFB, Washington, D.C.
AFOSR (AIR FORCE OFFICE OF SCIENTIFIC RESEARCH) TECHNICAL REPORT SUMMARIES Quarterly Report, Jul. - Sep. 1985
Barbara J. Wert Sep. 1985 105 p
(AD-A162372; AFOSR-85-0985TR) Avail: NTIS HC A06/MF A01 CSCL 05/2

The Air Force Office of Scientific Research Technical Report Summaries are published quarterly as of March, June, September, and December of each calender of each calender year. They consist of a brief summary of each AFOSR technical report received in the Technical Information Division and submitted to the Defense Technical Information Center (DTIC) for that quarter. The summaries contain two indexes for easily locating the technical reports that may be of interest to the user. These are followed by abstracts of the reports. The purpose of this report is to inform Air Force

Laboratories about the science that the Air Force Office of Scientific Research is supporting. GRA

N86-24571# California Univ., Berkeley. Electronics Research Lab.
A GENERALIZED DBMS TO SUPPORT DIVERSE DATA Annual Scientific Report, 1 Jul. 1983 - 30 Jun. 1984
L. Rowe, M. Stonebraker, and E. Wong 9 Sep. 1985 93 p
(Grant AF-AFOSR-0254-83)
(AD-A162384; AFOSR-85-0989TR) Avail: NTIS HC A05/MF A01 CSCL 09/2

The authors proposed a research program to develop a generalized database manager to support diverse kinds of data including text, icons, forms, maps and other spatial data. The proposed research also included investigating support for integrated data browsers to allow end-users to query, step through, and update diverse data. Specific topics to be investigated included query language facilities to support text and geometric data, user-defined abstract data types in a DBMS, an ordered relation access method for text and other ordered data, extended secondary indexes, main memory databases, concurrency control for data browsers, and an application program interface based on windows. This paper reports on our progress during the first year of this program. The major advances have been made in the areas of abstract data types, main memory data bases and extended secondary indexes. Author (GRA)

N86-24572# Allied Bendix Corp., Kansas City, Mo.
KEEPING TRACK OF ARCHIVED DRAWINGS: A CASE STUDY
B. C. Gault Oct. 1985 21 p Presented at the Applicon Users Group Fall Technical Meeting, Boston, Mass., 28 Oct. 1985
(Contract DE-AC04-76DP-00613)
(DE86-003129; BDX-613-3386; CONF-8510207-2) Avail: NTIS HC A02/MF A01

The Drafting Systems organization at Allied Corporation, Bendix Kansas City Division (BKC), is responsible for the creation of computer-readable media used for producing photoplots, phototools, and production traveler illustrations. From 1977 when the organization acquired its first Applicon system, until now, there have been over 50,000 different plots produced. Keeping track of what plot is on what archived tape has become a very tedious and time consuming task. This paper describes a software package using Datatrieve and TDMS running on a VAX 11/750 and how it has solved this problem. DOE

N86-24573# National Bureau of Standards, Gaithersburg, Md. Public Information Div.
NBS (NATIONAL BUREAU OF STANDARDS) RESEARCH REPORTS, SEPTEMBER 1985
S. Shaffer Sep. 1985 37 p
(PB86-129707; NBS-SP-680-4; LC-85-600575) Avail: NTIS HC A03/MF A01 CSCL 05B

Research at the Nationa Bureau of Standards (NBS) is reported. The following topics are included: research update; NBS high-tech ceramics program geared to needs of industry; NBS advanced-ceramics expertise, facilities available to industry; fiber optics-lighting the way to a communications revolution; new technique for measuring antenna performance pays off; seven NBS inventions picked as significant technological advances; assets frozen as researchers put pollution problems on ice; new instrument allows observation of surface magnetic microstructure; open systems in software; new publications; conference calendar. GRA

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N86-24574# Defense Systems Management School, Fort Belvoir, Va.
AIDS IN VALIDATING A CONTRACTOR'S COST ESTIMATE
Bernard H. Rudwick 1985 20 p Presented at the 19th Annual Department of Defense Cost Analysis Symposium, Leesburg, Va., 17-20 Sep. 1985
(AD-A161871) Avail: NTIS HC A02/MF A01 CSCL 05/1

One method that a government reviewer can use in validating a contractor's cost estimate is to motivate the contractor to generate the cost estimate properly, and to forward the entire analysis, including all of the data used, to the government for review. If the analysis has been done properly, the government's effort is reduced to one of checking, rather than independent cost estimating. Furthermore, if several contractors are providing estimates, the government review team can check corresponding parts of the analysis against one another, draw their own conclusions of what the CER input values should be (including the range of uncertainty of each input characteristic), and obtain a good bounded range of the estimated cost. This paper describes and illustrates the type of instructions which can be given to the contractors to provide such motivations, and how the government can use the contractor's data to obtain its own estimate. GRA

N86-24575# Clemson Univ., S.C.
COST UNCERTAINTY ASSESSMENT METHODOLOGY: A CRITICAL OVERVIEW
K. T. Wallenius Sep. 1985 19 p Presented at the 19th Annual Department of Defense Cost Analysis Symposium, Leesburg, Va., 17-20 Sep. 1985
(AD-A161920) Avail: NTIS HC A02/MF A01 CSCL 14/1

An appraisal of the quality of methodology and software for performing cost uncertainty analysis will be given. It will be argued that the standard practice of developing a most likely cost and then generating an uncertainty distribution associated with that figure is a consequence of historical precedent and places the cart before the horse. It will also be argued that methodology for encoding subjective probability distributions are out of date, being, for the most part, modifications of the PERT techniques of the sixties. Additionally, methodology for processing elemental uncertainty assessments into uncertainty distributions over higher order structures (e.g., subsystem CER's or total system cost) often ignores important sources of variability, and extent computer software designed to implement cost uncertainty analysis methodology is often poorly written and, in some cases, may lead to conclusions which are inconsistent with the inputs. This is a paper presented at a cost analysis symposium. GRA

N86-24576# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
ANALYSIS OF THE COST EFFECTIVENESS AND APPLICABILITY OF THE RELIABILITY TASKS OF MIL-STD-785B M.S. Thesis
Caren E. Atterbury Sep. 1985 70 p
(AD-A161952; AFIT/GSM/LSY/85S-1) Avail: NTIS HC A04/MF A01 CSCL 15/5

This thesis analyzed the cost effectiveness of the 18 tasks specified in MIL-STD-785B, Reliability Program for Systems and Equipment Development and Production. The purposes of the tasks are described and each task was evaluated according to six criteria. Cost effectiveness tables were developed for Airframe/Mechanical Equipment, Avionics/Electrical Equipment, and Space and Missile Systems. The tables shows averages taken from surveys completed by reliability instructors teaching at AFIT and reliability engineers employed by Aeronautical Systems Divisions and Air Force Aquisition Logistics Center. This analysis also includes a discussion of the applicability of the tasks according to program phase. GRA

N86-24577# Watervliet Arsenal, N.Y.
A1: A COMPUTER PROGRAM FOR ECONOMIC ANALYSIS
Augustine A. Stagliano 20 Sep. 1985 28 p Presented at the 19th Annual Department of Defense Cost Analysis Symposium, Leesburg, Va., 17-20 Sep. 1985
(AD-A162011) Avail: NTIS HC A03/MF A01 CSCL 09/2

Economic Analysis enjoys widespread use in the Department of Defense as an aid to insure that available funding is invested wisely. The post data collection stage of a cost study requires that analytical techniques, collectively termed economic analysis,

be performed. The resultng number crunching (pre-decision making stage), when performed manually, may require hours to complete. A1 is an interactive BASIC program modeled after format A-1 found in Army regulation 11-28. Written for the IBM PC, it may readily be converted for use with microcomputer systems throughout the Department of Defense. A1 is easy to use, requiring no computer experience. The results are highly reliable, with human error reduced to a minimum. A1 enjoys a high degree of applicability and allows for multiple runs (sensitivity analysis) with a minimum of effort. GRA

N86-24578# Department of the Navy, Washington, D. C.
STATISTICAL IMPROVEMENTS IN THE UNMANNED SPACECRAFT COST MODEL, MONOGRAPH 1
Brian Flynn Jun. 1985 26 p Presented at the 19th Annual Department of Defense Cost Analysis Symposium, Leesburg, Va., 17-20 Sep. 1985
(AD-A162016) Avail: NTIS HC A03/MF A01 CSCL 05/3

The purpose of this monograph is to test some of the CER's in the Unmanned Spacecraft Cost Model for non-constant error variances, or heteroskedasticity, and to take corrective statistical action if and where the problem is found. The Unmanned Spacecraft Cost Model is a set of regression equations or Cost Estimating Relationships (CER's) designed to explain the costs of spacecraft subsystems, such as electrical power supplies, apogee kick motors, and communication electronics. Technical and performance characteristics are used to explain costs, with the model based on 35 military, communications, weather, experimental, and lunar-probe spacecraft. The model presents equations for explaining both first-unit recurring costs and total nonrecurring costs, using normalized and unnormalized data. This paper, the first of five statistical monographs on the spacecraft model. GRA

N86-24579# Department of the Air Force, Washington, D.C.
IMPACT OF RELIABILITY/MAINTAINABILITY (R/M) ON LOGISTICS COSTS FOR USAF AIRCRAFT
Andrew J. Sherbo and J. Lochbaum 20 Sep. 1985 42 p Presented at the 19th Annual Department of Defense Cost Analysis Symposium, Leesburg, Va., 17-20 Sep. 1985
(AD-A162204) Avail: NTIS HC A03/MF A01 CSCL 15/5

The purpose of this study is to develop some cost estimating relationships (CERs) that supports the contention that higher R&M results in lower logistics support costs, and can be used in a variety of ways. Our primary need is a methodology that enables us to quantify the impact of R&M changes or levels on existing and new aircraft in terms of logistics support costs. The CERs we are searching for need to be at the weapon system level as opposed to the subsystem or component level. GRA

N86-24580# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
COMPARISON OF QUANTITY VERSUS QUALITY USING PERFORMANCE, RELIABILITY, AND LIFE CYCLE COST DATA. A CASE STUDY OF THE F-15, F-16, AND A-10 AIRCRAFT M.S. Thesis
David C. Merker Sep. 1985 100 p
(AD-A162238; AFIT/GSM/LSQ/85S-23) Avail: NTIS HC A05/MF A01 CSCL 14/1

The quantity versus quality issue is examined and a cost-effectiveness model designed to aid in evaluating it. This model incorporates mission effectiveness, readiness, and life cycle costs. The research effort was hinged around a case study comparison of the F-15, F-16, and A-10 aircraft. These aircraft were chosen because they represented varying system complexities and were used as surrogates to high, medium, and low complexity respectively. The comparisons made were intended to demonstrate the usefulness of using aircraft effectiveness, readiness and cost data in a mathematical cost-effectiveness model. The methodology followed combined multi-attribute value theory, aircraft readiness data, and aircraft life cycle cost information. The result was a series of cost-effectiveness ratios, and a cost-effectiveness curve which incorporated the three close air support aircraft. The cost-effectiveness curve provided the costs, adjusted by both effectiveness and readiness values. Author (GRA)

N86-24581# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
AN EVALUATION OF COMPONENT DEPENDENCE IN COST-RISK ANALYSIS M.S. Thesis
Robert E. Devaney and Philip T. Popovich Sep. 1985 279 p
(AD-A162274; AFIT/GSM/LSQ/85S-27) Avail: NTIS HC A13/MF A01 CSCL 05/1

This thesis project developed a cost-risk assessment method that incorporated the effects of cost dependency between components in a system. The method uses program personnels' subjective assessments of component dependency as inputs. A simulation model was developed and employed to test the method under various levels of component dependence strength and direction, estimation error, and system size. The analysis was accomplished by performing sensitivity analysis on the predictive capabilities of the cost-risk assessing method. Results indicate that the model has strong predictive capability when component size is small and when the direction of the component dependencies is mixed. It was also determined that the use of component dependency assessments produced more realistic total system cost variances than those produced under the assumption of component cost independence. GRA

N86-24582# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
RETENTION AND VALUE OF USAF COST ANALYSTS M.S. Thesis
Charles F. McNitt, Jr. Sep. 1985 65 p
(AD-A162275; AFIT/GSM/LSB/85S-22) Avail: NTIS HC A04/MF A01 CSCL 14/1

The questions of retention of and value of USAF cost analysts were examined in this thesis. The literature review covered meta-analysis, utility analysis, and human resource accounting to establish the method and validity of quantifying the value of an individual in the language of business, the dollar. The method is applicable to any career field. Published pay surveys and employment agencies were consulted to determine salary information, leading to the determination of the individual's value. The basic formula is S (separation costs) + R (replacement costs) + T (training costs) + IV (individual value) = TV (total value). There did not appear to be a problem with retention of USAF cost analysts at ths time. The value (loss to the Air Force) of a cost analyst varies greatly, but can be significant in absolute dollar terms. GRA

N86-24583# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
AN IDENTIFICATION OF OPERATING AND SUPPORT COST DRIVERS FOR COMMAND, CONTROL, COMMUNICATIONS AND INTELLIGENCE SYSTEMS M.S. Thesis
Elise K. Pitterle Sep. 1985 162 p
(AD-A162280; AFIT/GSM/LSY/85S-26) Avail: NTIS HC A08/MF A01 CSCL 05/3

This thesis researched the problems with life cycle costing of command, control, communication, and intelligence systems (C3I). As operating and support costs skyrocket it is imperative that the military design systems for reliability and maintainability to slow escalating costs. However, the cost drivers are unknown and no life cycle cost model exists specifically for C3I systems. This thesis used actual cost data categorized by type of equipment (radar, radio, wire, special/combination) and by usage mode (ground, portable, transportable, fixed, and mobile). A discriminant analysis showed that the four groups in the type category were significantly different based on cost data, and, likewise, that the five model groups differed significantly. Next a regression was performed, and the resultant correlation table indicated which variable was the cost driver for each group. The simple regression yielded the regression coefficients and y-intercept for the regression equations. These equations are the cost estimating relationships for C3I systems, based on the cost drivers identified by this thesis. GRA

N86-24584# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
AN EVALUATION OF CPRA (COST PERFORMANCE REPORT ANALYSIS) ESTIMATE AT COMPLETION TECHNIQUES BASED UPON AFWAL (AIR FORCE WRIGHT AERONAUTICAL LABORATORIES) COST/SCHEDULE CONTROL SYSTEM CRITERIA DATA M.S. Thesis
James B. Price Sep. 1985 67 p
(AD-A162282; AFIT/GSM/LSY/85S-28) Avail: NTIS HC A04/MF A01 CSCL 14/2

This thesis examined techniques used to derive estimates of the cost at completion for various research and development programs. The six methods examined were the methods used in the Cost Performance Report Analysis (CPRA) computer program to calculate estimates at completion. The analysis is based on a linear regression between the cost at completion for each technique available. The techniques were ranked by coefficient of determination and a general linear test was performed to test for equality among the regression lines. The results of this investigation indicate that an estimate at completion based upon weighted cost and schedule indices minimizes the unexplained error (as a percentage of total error) and is thought to be the superior forecaster of costs at completion. The general linear test for equality among the regression lines generated by the different techniques did not indicate the existence of commonality between regression lines. This means that each technique tested provided a unique estimate at completion. GRA

N86-24585# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
EVALUATION OF SPARING MODELS FOR A MISSILE SYSTEM M.S. Thesis
Lloyd A. Greene Sep. 1985 139 p
(AD-A162283; AFIT/GSM/LSY/85S-15) Avail: NTIS HC A07/MF A01 CSCL 14/1

This study investigated pipeline spares calculation with four life cycle cost models for the Maverick Missile System. The research goal was to evaluate any differences in the pipeline costs that were calculated by the Hughes Cost of Ownership Model, the Maverick Life Cycle Cost Model, and the Modified METRIC Maverick Model, and a variation of the Modified METRIC Maverick. The analysis was accomplished by identifying the independent variables with a Factor Analysis. A Factorial Design of three factors and five levels was used to develop the observations that were used by the life cycle costs models to calculate pipeline costs. The relative affect that each of the independent variables had upon the pipeline costs was evaluated by an Analysis of Variance. Differences in life cycle cost models pipeline costs were determined by Tukey's procedure. The results indicated that costs produced by the Hughes Cost of Ownership Model and the Modified MOD-METRIC Maverick calculated equal pipeline costs, but the Maverick Life Cycle Cost Model and the MOD-METRIC Maverick did not compute costs equal to any other life cycle cost model. The independent variables of Mean time Between Failure and the Depot Cycle Time had the most effect upon each of the life cycle costs models pipeline costs. Author (GRA)

N86-24586# Defense General Supply Center, Richmond, Va.
LOGMARS (LOGISTICS APPLICATIONS OF AUTOMATED MARKING AND READING SYMBOLS) CLEARINGHOUSE, APPLICATIONS DIRECTORY
Sep. 1985 134 p
(AD-A162327) Avail: NTIS HC A07/MF A01 CSCL 15/5

The DOD challenge is to improve material readiness, while also seeking ways to lower overall costs. The Logistics Applications of Automated Marking and Reading Symbols (LOGMARS) Program, using bar code technology in automated logistics systems, is ideally suited to achieve these objectives. Implementation of LOGMARS will increase productivity, reduce error rates, and improve the responsiveness of automated systems. This directory lists applications initiated by the various DOD components and the status of each. It is intended to eliminate duplicative development efforts within the components where application efforts are similiar. GRA

N86-24587# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
USE OF DATA ENVELOPMENT ANALYSIS IN COST ANALYSIS AND ESTIMATING
William F. Bowlin Sep. 1985 25 p Presented at the 19th Annual Department of Defense Cost Analysis Symposium, Leesburg, Va., 17-20 Sep. 1985
(AD-A162377) Avail: NTIS HC A02/MF A01 CSCL 14/1

Data Envelopment Analysis (DEA) was developed with the idea of evaluating the performance (measuring productivity or efficiency) of not-for-profit organizations. However, it appears that DEA also has potential as a tool for use in traditional cost estimating/analysis roles. The purpose of this paper is to briefly introduce the DEA methodology to the cost analysis community. We proceed in this paper by first presenting the DEA model formulation. This is followed by a description of the characteristics and conventions of the DEA model. The next section provides an example of the formulation of the DEA model for a specific analysis. The paper concludes with a discussion on possible avenues of DEA use in cost estimating/analysis. GRA

N86-24588# Space Command, Peterson AFB, Colo. Cost and Economic Analysis Div.
PRIMER ON OPERATING AND SUPPORT (O AND S) COSTS FOR SPACE SYSTEMS
Robert H. Lamontagne Sep. 1985 16 p Presented at the 19th Annual Department of Defense Cost Analysis Symposium, Leesburg, Va., 17-20 Sep. 1985
(AD-A162381) Avail: NTIS HC A02/MF A01 CSCL 14/1

Currently, the most common space system is the satellite with its associated ground-based support facilities. However, other systems are currently being developed such as the Strategic Defense Initiative (SDI), Space Station, space based radar, anti-satellite weapon, and others. Our difficulty in the cost community is in developing O&S cost estimates for all these systems. As a result HQ Space Command/ACM is in the process of developing a primer on O&S costs for Space Systems. It is intended to provide some guidelines and fundamentals for estimating the O&S cost for space systems; to address the O&S costs associated with space systems; and to present methodologies and factors to estimate the O&S costs. An O&S cost element structure will be developed for space systems. The primer will result in providing cost visibility for space systems for developing budget and life cycle cost estimates and analyses. GRA

N86-24589# Logistics Management Inst., Washington, D. C.
DISCOUNTED CASH FLOW MODEL FOR THE INDUSTRIAL MODERNIZATION INCENTIVES PROGRAM
Myron G. Myers, Paul R. McClenon, Michael J. Konvalinka, and Geneese Gottschalk Nov. 1985 47 p
(Contract MDA903-85-C-0139)
(AD-A162968; LMI-RE301) Avail: NTIS HC A03/MF A01 CSCL 05/3

Determining the appropriate productivity savings reward under an Industrial Modernization Incentives Program agreement requires identification of the total potential reduction in contract price. The contract price must be determined for each of two situations, one with business as usual and one after the proposed productivity enhancement. Finding these two sets of expected contract prices requires consideration of changes in direct and indirect cost and changes in profit objectives in each year of the period under analysis. Discounted cash flow analysis is the appropriate tool for evaluating the financial attractiveness to the contractor of a proposed investment. Contractor-related cash flow includes payments based on depreciation, imputed cost of money, and profit, which is influenced by cost and by facilities capital employed. Contractor return on investment is usually evaluated in after-tax terms, which implies a need to consider the accelerated cost recovery system and investment tax credit provisions of the Internal Revenue Code. The cash flow model documented in this report provides evaluations of proposed savings share provisions. It identifies the benefit to DOD and to the U.S. Government (including income tax effects). It measures the internal rate of return to the

contractor. The parties are expected to evaluate several possible savings share arrangements in the process of developing an equitable contractural agreement. GRA

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

No abstracts in this category.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N86-24590*# Integral Technologies, Inc., Westmont, Ill.
METHODS FOR HEAT TRANSFER AND TEMPERATURE FIELD ANALYSIS OF THE INSULATED DIESEL PHASE 2 PROGRESS REPORT Interim Report
Thomas Morel, Rifat Kerlbar, Edward F. Fort, and Paul N. Blumberg Sep. 1985 319 p refs
(Contracts DEN3-342; DE-AI01-80CS-50194)
(NASA-CR-175072; DOE/NASA/0342-2; NAS 1.26:175072) Avail: NTIS HC A14/MF A01 CSCL 13F

This report describes work done during Phase 2 of a 3 year program aimed at developing a comprehensive heat transfer and thermal analysis methodology for design analysis of insulated diesel engines. The overall program addresses all the key heat transfer issues: (1) spatially and time-resolved convective and radiative in-cylinder heat transfer, (2) steady-state conduction in the overall structure, and (3) cyclical and load/speed temperature transients in the engine structure. During Phase 2, radiation heat transfer model was developed, which accounts for soot formation and burn up. A methodology was developed for carrying out the multi-dimensional finite-element heat conduction calculations within the framework of thermodynamic cycle codes. Studies were carried out using the integrated methodology to address key issues in low heat rejection engines. A wide ranging design analysis matrix was covered, including a variety of insulation strategies, recovery devices and base engine configurations. A single cylinder Cummins engine was installed at Purdue University, and it was brought to a full operational status. The development of instrumentation was continued, concentrating on radiation heat flux detector, total heat flux probe, and accurate pressure-crank angle data acquisition. Author

N86-24591# Joint Publications Research Service, Arlington, Va.
WEST EUROPE REPORT: SCIENCE AND TECHNOLOGY. FRG INFORMATION TECHNOLOGY Annual Report, 1984
28 Mar. 1986 60 p
(JPRS-WST-86-015) Avail: NTIS HC A04/MF A01

The guiding principles of research and technology policy as well as the resources that exist in the Federal Republic of Germany (FRG) in the areas of science, research and development are described. Research activities and facilities that are supported by the federal and state governments as well as an overview comparing the international cooperation and support for scientific investigation carried out by the FRG are presented. Author

N86-24592# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany).
[ACTIVITIES REPORT IN AEROSPACE IN WEST GERMANY] Annual Report, 1984
Aug. 1984 119 p In GERMAN; ENGLISH summary Original contains color illustrations
(ISSN-0070-3966) Avail: NTIS HC A06/MF A01

Research and development in air traffic management; aircraft technology; turbopropulsion and turbomachinery; nonnuclear energy systems; satellite communication and localization; remote sensing of the Earth; space systems; advanced technologies; and technology transfer are summarized. Project management, organization, DFVLR personnel, and financial development are presented. Author (ESA)

N86-24593# Kernforschungsanlage, Juelich (West Germany). Programmgruppe Technik und Gesellschaft.
THE TRANSFER OF SCIENTIFIC KNOWLEDGE TO THE GENERAL PUBLIC FROM THE POINT OF VIEW OF SCIENTISTS. RESULTS OF A SURVEY AMONG THE SCIENTIFIC PERSONNEL OF THE KERNSFORSCHUNG, JUELICH, WEST GERMANY [DER TRANSFER WISSENSCHAFTLICHEN WISSENS IN DIE OEFFENTLICHKEIT AUS DER SICHT VON WISSENSCHAFTEN. ERGEBNISSE EINER BEFRAGUNG DER WISSENSCHAFTLICHEN MITARBEITER DER KERNFORSCHUNGSANLAGE JUELICH]
H. P. Peters and J. Krueger Jul. 1985 88 p In GERMAN; ENGLISH summary
(JUEL-Spez-323; ISSN-0343-7639) Avail: NTIS HC A05/MF A01

A survey of 800 scientists at a nuclear research institute was conducted to analyze the attitudes and experiences of scientists regarding the mass media and general public. Nearly all scientists agree that they have responsibilities to disseminate information about their work, not only to colleages but also to the general public; two-thirds perceive personal benefits. Most scientists rate the interest of the population in reports on science at least as medium, but most of them are sceptical of the population's ability to understand those reports. Only a minority perceives hostility against science among the public. About 40% of the respondants had contact with journalists, often with negative experiences such as incorrect reporting in the media. There are indications that scientists do not see science reporting solely as a task of journalists. However, their ideas of good science reporting contradict the journalistic approach. Therefore, the collision of scientific standards and values with those of journalism leads to experiences which are frustrating for both sides, although scientists and journalists agree on the general goal of public information. Author (ESA)

88 SPACE SCIENCES (GENERAL)

N86-24594# Technische Univ., Berlin (West Germany). Inst. fuer Astronomie und Astrophysik.
[ACTIVITIES REPORT OF THE INSTITUTE OF ASTRONOMY AND ASTROPHYSICS] Annual Report, 1984 [JAHRESBERICHT, 1984]
R. Wielen 1985 10 p refs In GERMAN
Avail: NTIS HC A02/MF A01

Research concerning stars and interstellar matter (variable stars and X-ray sources, dust formation); and stellar systems (astronomy satellite HIPPARCOS, stars close to the Sun, star clusters, Milky way and galaxies, galactic clusters) is summarized. Author (ESA)

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N86-24595 Delaware Univ., Newark.
A STUDY OF HYBRID ATMOSPHERE STARS: TRANSITION

REGION MODELING AND CHROMOSPHERIC EMISSION VARIABILITY Ph.D. Thesis
Jeffrey W. Brosius 1985 148 p
Avail: Univ. Microfilms Order No. DA8525286

Models of the transition regions of six hybrid atmosphere stars are presented. The models include mass loss, and are based on an analysis of IUE data. The equations which were used to describe the mass loss are sufficiently general that the momentum and energy deposition rates which are required at each level of the atmosphere can be evaluated. This approach allows a self-consistency check on the model at the critical point in the flow, thereby restricting the acceptable models to a small region of parameter space. Final models for all 6 stars have loss rates which lie below the current VLA upper limits by factors of 2 to 0.5 R_*). The IUE has also used data to study temporal variations of the Mg II h and k emission lines in the hybrids and two additional late-type giants. Dissert. Abstr.

N86-24596 Princeton Univ., N. J.
THEORETICAL STELLAR LUMINOSITY FUNCTIONS AND GLOBULAR CLUSTER AGES AND COMPOSITIONS Ph.D. Thesis
Stephen Jackson Ratcliff 1985 287 p
Avail: Univ. Microfilms Order No. DA8529046

The ages and chemical compositions of the stars in globular clusters are of great interest, particularly because age estimates from the well known exercise of fitting observed color-magnitude diagrams to theoretical predictions tend to yield ages in excess of the Hubble time in standard cosmological models. Relatively little use was made of the stellar luminosity functions of the globular clusters to constrain the ages or compositions. The comparison of observed luminosity functions to theoretical ones allows the use of information not usually considered, and has the advantage of being relatively insensitive to lack of knowledge of the detailed structure of stellar envelopes and atmospheres. A computer program was developed to apply standard stellar evolutionary theory, using the most recently available input physics to the calculation of the evolution of low-mass Population II stars. A comparison of the computed theoretical luminosity functions to an observed, though still preliminary, luminosity function for the cluster M13 demonstrates the viability of this approach. Dissert. Abstr.

N86-24597*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
WORLD ATLAS OF LARGE OPTICAL TELESCOPES (SECOND EDITION)
Stephen Paul Meszaros Apr. 1986 44 p refs
(NASA-TM-87775; NAS 1.15:87775) Avail: NTIS HC A03/MF A01 CSCL 03A

By early 1986 there will be over 120 large optical telescopes in the world engaged in astronomical research with mirror or lens diameters of one meter (39-inches) and larger. This atlas gives information on these telescopes and shows their observatory sites on continent sized maps. Also shown are observatory locations considered suitable for the construction of future large telescopes. Of the 126 major telescopes listed in this atlas, 101 are situated in the Northern Hemisphere and 25 are located in the Southern Hemisphere. The totals by regions are as follows: Europe (excluding the USSR), 30; Soviet Union, 9; Asia (excluding the USSR), 5; Africa, 9; Australia, 6; The Pacific, 4 (all on Hawaii); South America, 17; North America, 46 (the continental US has 38 of these). In all, the United States has 42 of the world's major telescopes on its territory (continental US plus Hawaii) making it by far the leading nation in astronomical instrumentation. Author

N86-24598*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
BALLOON-BORNE THREE-METER TELESCOPE FOR FAR-INFRARED AND SUBMILLIMETER ASTRONOMY Semiannual Status Report
Giovanni G. Fazio Apr. 1986 38 p refs
(Grant NAGw-509)
(NASA-CR-176748; NAS 1.26:176748; SASR-5) Avail: NTIS HC A03/MF A01 CSCL 03A

The drawbacks uncovered in the initial gimbal design are reviewed. The behavior of ball bearings are considered and two candidate gimbal designs are proposed which overcome the problems the initial flex pivot based design. Author

N86-24541*# Tennessee Technological Univ., Cookeville. Dept. of Mathematics and Computer Science.
RELIABILITY MODELS APPLICABLE TO SPACE TELESCOPE SOLAR ARRAY ASSEMBLY SYSTEM
S. A. Patil *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 26 p refs (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 03A

N86-24616*# Harvard-Smithsonian Center for Astrophysics, Cambridge, Mass.
THE SUN AT HIGH SPATIAL RESOLUTION: THE PHYSICS OF SMALL SPATIAL STRUCTURES IN A MAGNETIZED MEDIUM
Robert T. Rosner *In* NASA. Marshall Space Flight Center Solar Flares and Coronal Physics Using P/OF as a Research Tool Apr. 1986 p 14-27 refs (For primary document see N86-24614 14-92) (Grants NAGw-79; NAGw-112)
Avail: NTIS HC A14/MF A01 CSCL 03A

N86-24639*# Naval Research Lab., Washington, D. C. Center for Space Research.
THE PINHOLE/OCCULTER AS A TOOL FOR X-RAY ASTRONOMY
Kent S. Wood *In* NASA. Marshall Space Flight Center Solar Flares and Coronal Physics Using P/OF as a Research Tool Apr. 1986 p 277-295 refs (For primary document see N86-24614 14-92)
Avail: NTIS HC A14/MF A01 CSCL 03A

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N86-24599 Ohio State Univ., Columbus.
PROTON THRESHOLD STATES IN Al-26 AND THEIR ROLE IN ASTROPHYSICS Ph.D. Thesis
Vythilingam Wijekumar 1985 114 p
Avail: Univ. Microfilms Order No. DA8526275

The energy levels of Al-25 between E sub x = 6.3 and 6.5 S.5 MeV, corresponding to proton threshold energies in the mg-25+p reaction from E subp = 0 Al-26 to 200 keV, were investigated using the reactions a doublet at E sub x = 6362 keV, most subsequent work reported a single state with conflicting spin and parity assignments. The presence of the doublet is established and the conflicts resolved. There are six states in this excitation energy region, including a new state at E sub x = 6410 + or - 5 keV. The limits on the branching ratios from these states to the ground state of Al-26 were obtained by using the reaction Al-27(He-3, alpha, gamma)Al-26. Finally by combining the results of the above experiments, stellar reactions rates of the mg-25(p, gamma)Al-26 reaction were calculated. Results conclude that the reduction rate of Al-26 in stellar environments from the reaction mg-25(p,gamma)Al-26 is substantially higher than what was calculated from other work. Dissert. Abstr.

N86-24600 Arizona Univ., Tucson.
THE INFLUENCE OF GALAXY INTERACTIONS OF NUCLEAR ACTIVITY Ph.D. Thesis
Roc Michael Curti 1985 187 p
Avail: Univ. Microfilms Order No. DA8525594

This dissertation examines empirically the effects of gravitational interactions between galaxies on their respective nuclei with the primary motivation of investigating the possible connection between such interactions and the presence of vigorous nuclear

activity. To carry out this work, ground based near and mid-infrared observations, along with the mid- and far infrared data of IRAS of a statistically complete sample of interacting galaxies drawn from the Catalog of Isolated Pairs of Galaxies in the Northern Hemisphere (Karachentsev 1972) were utilized. Also performed were detailed probes of four known active, interacting and possible interacting systems, which made use of infrared multiaperture photometry and spectrophotometry. Comparison of the nuclear infrared properties of the interacting galaxies with samples of non-interacting galaxies shows that abnormal activity, characterized by excess 10 micro m emission or extremely red or blue near infrared colors, is much more common in the interacting systems. In particular, a population of nuclei with extremely luminous 10 micro m emission appears to be unique to the interacting sample. Dissert. Abstr.

N86-24601 California Inst. of Tech., Pasadena.
A STUDY OF THE FORMATION AND DYNAMICS OF GALAXIES Ph.D. Thesis
James Arthur Fillmore 1985 160 p
Avail: Univ. Microfilms Order No. DA8522612

The first half of this thesis is a study on the growth of perturbations in the early universe which might lead to galaxies, clusters of galaxies, or regions void of galaxies. The growth of self-similar perturbations in an Einstein-deSitter universe with cold, collisionless particles is investigated. Three classes of solutions are obtained; one each with planar, cylindrical, and spherical symmetry. The solutions follow the development of structure in both the linear and nonlinear regimes. Self-similar spherical voids which develop from initially underdense regions are also investigated. The character of each solution depends upon the initial density deficit. The second half of this thesis details solutions of steady-state axisymmetric models of elliptical and disk galaxies, and considers which observable properties can be used as diagnostics of the kinematic configuration of the spheroidal component of these systems. Two component mass models are fitted to surface brightness measurements and used to fit kinematic models to the velocity data. Dissert. Abstr.

N86-24602 Cornell Univ., Ithaca, N.Y.
GAS DYNAMICAL STRIPPING OF GALAXIES Ph.D. Thesis
Terrance Joseph Gaetz 1985 198 p
Avail: Univ. Microfilms Order No. DA8525692

Results are presented for a series of numerical models of gas dynamical stripping of spherical galaxies moving through a uniform intergalactic medium. The models include replenishment of the interstellar medium by stellar deaths, removal of cold dense gas by a nominal star formation process, and radiative cooling by both thermal bremsstrahlung and collisionally-excited line emission. The effective distributions for the gas replenishment are chosen to mimic cases in which the replenished gas is mildly stirred by galactic fountains; this generates a broader distribution of gas than indicated by the distribution of luminous material in galaxies, but the injection of energy by supernovae is not sufficient to drive an actual galactic wind. The galaxy starts out with no interstellar gas; replenishment of the interstellar medium by star deaths begins at $t = 0$. Because sinks for the gas production are provided in addition to sources, the flow can evolve to a true steady state, unlike previous models without cooling flows or star formation. The stripping of gas from galaxies is found to proceed by a combination of the following mechanisms: (1) sufficient momentum is transferred from the intergalactic gas to accelerate the interstellar gas to escape velocity; (2) sufficient kinetic energy is converted into heat to unbind the interstellar gas; (3) gas is stripped off by a rarefaction wave in the wake. Dissert. Abstr.

N86-24603 State Univ. of New York, Stony Brook.
THE EQUATION OF STATE AND GENERAL RELATIVITY IN SUPERNOVAE Ph.D. Thesis
Edward Arthur Baron 1985 127 p
Avail: Univ. Microfilms Order No. DA8527931

The results of an extensive numerical study of the outcome of massive star collapse and subsequent shock formation and propagation are presented. The stiffness of the equation of state at high density is shown to play a crucial role, a softer equation of state being helpful to shock production and propagation. The effect of neutrinos is investigated in a simple manner by varying the neutrino transport from a simple trapping density to a simple leakage scheme. With a softer equation of state the maximum central densities reached are high enough that general relativity may become important. The effects of general relativity are investigated in detail. It is shown that while general relativity is generally harmful to the shock, once the equation of state becomes soft enough, general relativistic effects may conspire to transfer large amounts of energy from the gravitational field to the shock, resulting in powerful explosions. This is first investigated using simplified initial conditions, the initial models being constructed in an ad hoc fashion to facilitate numerical investigation.
Dissert. Abstr.

N86-24604 Clemson Univ., S.C.
ANALYSIS OF COLOR-MAGNITUDE DIAGRAMS FROM THREE LARGE MAGELLANIC CLOUD CLUSTERS Ph.D. Thesis
Joseph Heilman Jones 1985 230 p
Avail: Univ. Microfilms Order No. DA8527701

The color-magnitude diagrams of three large Magellanic Cloud (LMC) clusters and a field were derived from photographic and CCD data provided by Dr. P. J. Flower of Clemson University and Dr. R. Schommer of Rutgers University. The photographic data were scanned and converted to intensity images at KPNO. The stellar photometry program RICHFLD was used to measure the raw magnitudes from these images. Problems with the standard sequence on the plate kept the color terms for the photographic data from being well determined. A version of DAOPHOT was installed on the VAX 11/280s at Clemson and was used to measure the magnitudes from the CCD images of NGC 2249. These magnitudes were used to define another photoelectric sequence for the photographic data which were used to determine a well defined transformation into the standard BV system. Dissert. Abstr.

N86-24605 Minnesota Univ., Minneapolis.
THE DISTRIBUTION AND KINEMATICS OF NEUTRAL HYDROGEN GAS AND THE RADIO CONTINUUM EMISSION IN BARRED SPIRAL GALAXIES Ph.D. Thesis
Marc Philip Ondrechen 1985 222 p
Avail: Univ. Microfilms Order No. DA8526496

Very Large Array (VLA) radio synthesis observations of three barred spiral galaxies, NGC 1097, NGC 1365 and M83 were presented. Neutral hydrogen spectral line observations were made, as well as continuum observations at wavelengths of 6 cm and 20 cm. The continuum observations of the bars of NGC 1097 and M83 reveal that the radio emission is coincident with the linear dust lanes in the bars, that is nonthermal in origin, and is moderately polarized. These data show that the dust lanes are generated by shocks, confirming a major theoretical prediction of bar structure. Spectral line observations of the neutral hydrogen gas reveal many interesting properties of these galaxies. Direct observation of the gas flow in the bar of NGC 1097 has confirmed the presence of noncircular motions, of similar magnitude to those predicted based on the presence of the bar and its associated shocks. Non-circular motions in the spiral arms of NGC 1097 and NGC 1365 were also found. Dissert. Abstr.

N86-24606 Tufts Univ., Boston, Mass.
PROPERTIES AND CONSEQUENCES OF TOPOLOGICAL STRUCTURES IN THE EARLY UNIVERSE Ph.D. Thesis
Tanmay Vachaspati 1985 132 p
Avail: Univ. Microfilms Order No. DA8526853

Grand Unified Theories predict the existence of topological structures in the early universe. The properties and consequences of having such topological structures in the early universe are examined. The statistical properties of the system of strings produced at a phase transition in the early universe are studied using a Monte Carlo simulation. The fractal dimension of the strings and the size distribution of closed loops are determined. Gravitational radiation from oscillating loops of strings is studied

both analytically and numerically. The intensity and the spectrum of the stochastic gravitational wave background produced by the loops are calculated. The momentum radiation rate from loops is calculated. The order of magnitude of the emission rate of electromagnetic waves, and of massive scalar particles is calculated from oscillating strings and domain walls. Results are used to analyze the cosmological evolution of strings. Formation of domain walls and walls bounded by strings is also discussed.
Dissert. Abstr.

N86-24607# Delaware Univ., Newark. Research Foundation.
PARTICLE THEORY AND COSMOLOGY Progress Report, 1 Apr. 1985 - 31 Mar. 1986
T. K. Gaisser and G. Steigman 15 Nov. 1985 10 p refs
(Contract DE-AC02-78ER-05007)
(DE86-003169; DOE/ER-05007/22) Avail: NTIS HC A02/MF A01

A review of work in progress is given for models, using properties of particle interactions to extrapolate to energy realms which exceed accelerator limits. In addition models are discussed for cosmology and astrophysics. DOE

N86-24608# Fermi National Accelerator Lab., Batavia, Ill.
SEARCHING FOR CYGNETS
E. W. Kolb Sep. 1985 11 p refs Presented at the 5th International Conference on Physics in Collision, Autun, France, 3 Jul. 1985
(Contract DE-AC02-76CH-03000)
(DE86-002994; FNAL/C-85/134-A; CONF-850785-5; CONF-8506195-2) Avail: NTIS HC A02/MF A01

The reported observation in underground detectors of high-energy muons from the direction of the compact binary X-ray source CYG X-3 (2030 + 4047) cannot be explained by conventional physics. In this paper some explanations for the effect based upon unconventional physics are reviewed. DOE

N86-24609# California Univ., Berkeley. Lawrence Berkeley Lab.
EVIDENCE FOR NEMESIS: A SOLAR COMPANION STAR
R. A. Muller Jan. 1985 20 p refs Presented at the Conference on the Galaxy and the Solar System, Tucson, Ariz., 10 Jan. 1985
(Contract DE-AC03-76SF-00098)
(DE86-003991; LBL-20438; CONF-850183-1) Avail: NTIS HC A02/MF A01

The evidence that the Sun has a companion star Nemesis responsible for periodic mass extinctions is reviewed. A gaussian ideogram of the rates of family extinctions in the oceans shows periods of 26 and 30 Myr. Analysis of impact cratering on the earth shows a period of either 28.4 or 30 Myr, depending on the crater selection. Models which attempt to explain these periods with either oscillations through the galactic plane, or through the effects of a tenth planet, are seriously flawed. If the periods seen in the data are real (and not a spurious result of a statistical fluctuation) then the Nemesis hypothesis is the only suggested explanation that has survived close scrutiny. The Nemesis model predicts that the impacts took place during brief storms of several million years duration, perhaps accounting for the extended nature of the mass extinctions. A search for Nemesis is under way at Berkeley. DOE

N86-23863# Kyoto Univ. (Japan). Dept. of Aeronautical Engineering.
NUMERICAL SIMULATIONS IN COSMIC GAS DYNAMICS: GAS FLOWS IN BINARY STARS
Takuya Matsuda *In* Tokyo Univ. Proceedings of the Symposium on Mechanics for Space Flight Mar. 1985 p 51-66 refs Sponsored in part by the Ministry of Education, Science and Culture, Japan
(For primary document see N86-23858 14-34)
Avail: NTIS HC A08/MF A01

N86-24539*# Naval Postgraduate School, Monterey, Calif. Dept. of Physics.
RADIATIVELY DRIVEN WINDS FROM MAGNETIC, FAST-ROTATING STARS
Steven Nerney *In* NASA. Marshall Space Flight Center Research Reports: 1985 NASA/ASEE Summer Faculty Fellowship Program Jan. 1986 16 p refs (For primary document see N86-24507 14-80)
Avail: NTIS HC A99/MF E04 CSCL 03B

N86-24629*# Colorado Univ., Boulder. Dept. of Astrophysical, Planetary and Atmospheric Sciences.
RADIO IMAGING OF FLARES
George A. Dulk *In* NASA. Marshall Space Flight Center Solar Flares and Coronal Physics Using P/OF as a Research Tool Apr. 1986 p 178-190 refs (For primary document see N86-24614 14-92)
(Grants NsG-7287; NAGw-91)
Avail: NTIS HC A14/MF A01 CSCL 03B

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance.* For space stations see *15 Launch Vehicles and Space Vehicles.*

N86-24610 Colorado Univ., Boulder.
THE AERONOMY AND RADIATIVE TRANSFER OF THE MARTIAN ATMOSPHERE Ph.D. Thesis
Bernhard Leo Lindner 1985 492 p
Avail: Univ. Microfilms Order No. DA8528505

A radiative-photochemical computer model was used to study the aeronomy and radiative transfer of the Martian winter-polar atmosphere. The discrete ordinate method and exponential-sum approximation are used to combined scattering, emission and absorption by dust, clouds and gas. Infrared modifications to the discrete ordinate method are addressed. The photochemistry of a cloudy, dusty atmosphere is examined for a variety of conditions. The observed O3 maximum is reproduced. Clouds reduce ozone abundances a few percent. Typical dust abundances induce 10 to 30% increases in ozone abundances. Annual, latitudinal and seasonal variations in O3 are discussed. Photodissociation rates are drastically reduced by the dust. The efficacy of the reflectance spectroscopy technique to observe the total ozone column abundance is questioned. Dissert. Abstr.

N86-24611# Atmospheric and Environmental Research, Inc., Cambridge, Mass.
COMETARY ATMOSPHERES: MODELING THE SPATIAL DISTRIBUTION OF OBSERVED NEUTRAL RADICALS Interim Report, Dec. 1985 - Feb. 1986
Michael R. Combi Apr. 1986 8 p refs
(Contract NASw-3950)
(NASA-CR-176753; NAS 1.26:176753) Avail: NTIS HC A02/MF A01 CSCL 03B

A re-analysis of published observational data concerning the spatial distributions of cometary C3 and OH has begun. Haser model scale lengths have been compiled for twelve brightness profiles. Very preliminary results for C3 show a much larger variation of scale lengths with changing heliocentric distance than has been previously recognized. Scale lengths found for OH are somewhat larger than currently accepted values. Author

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N86-24612 Wisconsin Univ., Madison.
THE SOFT X-RAY BACKGROUND AS A BLAST WAVE VIEWED FROM INSIDE Ph.D. Thesis
Richard John Edgar 1985 146 p

Avail: Univ. Microfilms Order No. DA8519761

A model of the soft X-ray background is presented in which the Sun is assumed to be inside an active supernova blast wave. The broadband surface brightnesses can be explained by such a blast wave with an explosion energy of E sub o is equal to or greater than 5 x 10 to the 50th power ergs and radius 80 to 100 pc, using solar abundances. The dynamical model used includes the effects of thermal conduction, as the electrons are assumed to be heated by non-Coulomb processes in the shock front. At early times these effects are important, but as the temperature drops with time, they fade away and the structure approaches that of an adiabatic blast wave. An approach to treating the problem of large anisotropies in the ambient medium is also explored, accommodating the observed anticorrelation between the soft X-ray surface brightness and the column density of neutral hydrogen. It is found that only for post shock temperatures below 1,000,000 6 K will a shock propagating into a density enhancement be dimmer than a shock of similar pressure in a medium of lower density.

Dissert. Abstr.

N86-24613 Colorado Univ., Boulder.

IMPULSIVE BRIGHTENINGS IN QUIESCENT SOLAR PROMINENCES Ph.D. Thesis

George David Toot 1985 250 p

Avail: Univ. Microfilms Order No. DA8528529

At large spatial scales, quiescent solar prominences appear static in nature, but are dynamic at smaller scales. High resolution observations of quiescent prominences using the tunable, Universal Birefringent Filter and the echelle spectrograph on the Vacuum Tower Telescope at Sacramento Peak Observatory are presented. More than 40 hours of wavelength scans of H alpha and He D3 disclose a class of activity near the edges of quiescent prominences, characterized by enhancement of H alpha radiative power by as much 4 x 10 to the 24th power erg/s and enhanced line widths of up to 0.92 A, over areas 5 to 25 arcseconds across, for lifetimes of tens of minutes; this activity is called impulsive brightenings. The H alpha and profile is centrally reversed by as much as 25% in some, while others contain significant line-of-sight velocities. Three models for impulsive brightenings are considered: a layer of cool material between the observer and the prominence, magnetic reconnection as an energy source for the activity, and condensation of coronal material into the prominence.

Dissert. Abstr.

N86-24614*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

SOLAR FLARES AND CORONAL PHYSICS USING P/OF AS A RESEARCH TOOL

Einar Tandberg, ed., Robert M. Wilson, ed., and Robert M. Hudson, ed. (California Univ., San Diego, La Jolla) Apr. 1986 307 p refs Workshop held in Huntsville, Ala., 8-10 May 1985

(NASA-CP-2421; M-523; NAS 1.55:2421) Avail: NTIS HC A14/MF A01 CSCL 03B

This NASA Conference Publication contains the proceedings of the Workshop on Solar High-Resolution Astrophysics Using the Pinhole/Occulter Facility held at NASA Marshall Space Flight Center, Alabama, on May 8 to 10, 1985. These proceedings include primarily the invited tutorial papers, extended abstracts of contributed poster papers, and summaries of subpanel (X-Ray and Coronal Physics) discussions. Both observational and theoretical results are presented. Although the emphasis of the Workshop was focused primarily on topics peculiar to solar physics, one paper is included that discusses the P/0F as a tool for X-ray astronomy. For individual titles, see N86-24615 through N86-24639.

N86-24615*# California Univ., La Jolla.

THE CONCEPT OF THE PINHOLE/OCCULTER FACILITY c14

Hugh S. Hudson *In* NASA. Marshall Space Flight Center Solar Flares and Coronal Physics Using P/OF as a Research Tool Apr. 1986 p 5-13 refs (For primary document see N86-24614 14-92) (Grant NsG-7161)

Avail: NTIS HC A14/MF A01 CSCL 14B

The Pinhole/Occulter Facility is based on a simple idea for obtaining high angular resolution in astronomical X-ray observations, for example for solar flares at energies > 10 keV. The scheme uses a coded aperture device (multiple pinhole camera) with a large separation between the aperture encoder and the detector. Such an imaging device can have an angular resolution much better than 1 arc s if desired. A large structure would also make it possible to have a large external occulter, which would have powerful applications, notably for high-sensitivity observations of the corona in EUV and white light. This capability leads to the definition of the Pinhole/Occulter Facility, which combines both X-ray and coronal observations. The present concept is based on a 35-m deployable boom, erected in the cargo bay of the Space Shuttle and pointed in the solar direction by the Instrument Pointing System of Spacelab.

Author

N86-24616*# Harvard-Smithsonian Center for Astrophysics, Cambridge, Mass.

THE SUN AT HIGH SPATIAL RESOLUTION: THE PHYSICS OF SMALL SPATIAL STRUCTURES IN A MAGNETIZED MEDIUM c89

Robert T. Rosner *In* NASA. Marshall Space Flight Center Solar Flares and Coronal Physics Using P/OF as a Research Tool Apr. 1986 p 14-27 refs (For primary document see N86-24614 14-92) (Grants NAGw-79; NAGw-112)

Avail: NTIS HC A14/MF A01 CSCL 03A

An attempt is made to provide a perspective on the problem of spatial structuring on scales smaller than can presently be directly and regularly observed from the ground or with which current space-based instrumentation can be anticipated. There is abundant evidence from both observations and theory that such spatial structuring of the solar outer atmosphere is ubiquitous not only on the observed scales, but also on spatial scales down to (at least) the subarcsecond range. This is not to say that the results to be obtained from observations on these small scales can be anticipated: quite the opposite. What is clear instead is that many of the classic problems of coronal and chromospheric activity - involving the basic dissipative nature of magnetized plasmas - will be seen from a novel perspective at these scales, and that there are reasons for believing that dynamical processes of importance to activity on presently-resolved scales will themselves begin to be resolved on the sub-arcsecond level. Since the Sun is the only astrophysical laboratory for which there is any hope of studying these processes in any detail, this observatioinal opportunity is an exciting prospect for any student of magnetic activity in astrophysics.

Author

N86-24617*# Laboratorium voor Ruimteonderzoek, Utrecht (Netherlands).

THE FLARE KERNEL IN THE IMPULSIVE PHASE

Cornelis deJager *In* NASA. Marshall Space Flight Center Solar Flares and Coronal Physics Using P/OF as a Research Tool Apr. 1986 29-40 refs (For primary document see N86-24614 14-92)

Avail: NTIS HC A14/MF A01 CSCL 03B

The impulsive phase of a flare is characterized by impulsive bursts of X-ray and microwave radiation, related to impulsive footpoint heating up to 50 or 60 MK, by upward gas velocities (150 to 400 km/sec) and by a gradual increase of the flare's thermal energy content. These phenomena, as well as non-thermal effects, are all related to the impulsive energy injection into the flare. The available observations are also quantitatively consistent with a model in which energy is injected into the flare by beams of energetic electrons, causing ablation of chromospheric gas, followed by convective rise of gas. Thus, a hole is burned into the chromosphere; at the end of impulsive phase of an average flare the lower part of that hole is situated about 1800 km above the photosphere. H alpha and other optical and UV line emission is radiated by a thin layer (approx. 20 km) at the bottom of the flare kernel. The upward rising and outward streaming gas cools down by conduction in about 45 s. The non-thermal effects in the initial phase are due to curtailing of the energy distribution function by escape of energetic electrons. The single flux tube model of a flare does not fit with these observations; instead we

propose the spaghetti-bundle model. Microwave and gamma-ray observations suggest the occurrence of dense flare knots of approx. 800 km diameter, and of high temperature. Future observations should concentrate on locating the microwave/gamma-ray sources, and on determining the kernel's fine structure and the related multi-loop structure of the flaring area. Author

N86-24618*# Laboratorium voor Ruimteonderzoek, Utrecht (Netherlands).
X-RAY IMAGING OF FLARE LOOPS AND CORONAL ARCHES
Zdenek Svestka *In* NASA. Marshall Space Flight Center Solar Flares and Coronal Physics Using P/OF as a Research Tool Apr. 1986 p 41-66 refs (For primary document see N86-24614 14-92)
Avail: NTIS HC A14/MF A01 CSCL 03B

HXIS (Hard X-ray Imaging Spectrometer) results related to preflare, flare-decay, and post-flare phases in the solar corona are summarized. Particularly discussed are miniflares, long-lived X-ray enhancements along filament channels, flare precursors (some signifying the flare position, others possibly related to the onset of mass ejections), growth of post-flare loops, images of sites of field-line reconnections late in the flare development, giant post-flare coronal arches with energy contents comparable to coronal transients, and hot loops interconnecting active regions. The extremely low HXIS background, in particular, made it possible to discover many new, previously unknown features in the solar corona. Also emphasized are some problems that have appeared during the evaluation of HXIS data, for the benefit of those who plan future hard X-ray imaging experiments. Author

N86-24619*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RESULTS FROM THE SOLAR MAXIMUM MISSION
Brian R. Dennis *In* NASA. Marshall Space Flight Center Solar Flares and Coronal Physics Using P/OF as a Research Tool Apr. 1986 p 67-97 refs (For primary document see N86-24614 14-92)
Avail: NTIS HC A14/MF A01 CSCL 03B

The major results from SMM (Solar Max Mission) are presented as they relate to the understanding of the energy release and particle transportation processes that led to the high energy X-ray aspects of solar flares. Evidence is reviewed for a 152- to 158-day periodicity in various aspects of solar activity including the rate of occurrence of hard X-ray and gamma-ray flares. The statistical properties of over 7000 hard X-ray flares detected with the Hard X-Ray Burst Spectrometer are presented including the spectrum of peak rates and the distribution of the photo number spectrum. A flare classification scheme is used to divide flares into three different types. Type A flares have purely thermal, compact sources with very steep hard X-ray spectra. Type B flares are impulsive bursts which show double footpoints in hard X-rays, and soft-hard-soft spectral evolution. Type C flares have gradually varying hard X-ray and microwave fluxes from high altitudes and show hardening of the X-ray spectrum through the peak and on the decay. SSM data are presented for examples of Type B and Type C events. New results are presented showing coincident hard X rays, O V, and UV continuum observations in Type B events with a time resolution of < 128 ms. The subsecond variations in the hard X-ray flux during < 10% of the stronger events are discussed and the fastest observed variation in a time of 20 ms is presented. The properties of Type C flares are presented as determined primarily from the non-imaged hard X-ray and microwave spectral data. A model based on the association of Type C flares and coronal mass ejections is presented to explain many of the characteristics of these gradual flares. Author

N86-24620*# California Univ., Berkeley. Space Sciences Lab.
INTERPLANETARY ENERGETIC PARTICLES, CORONAL FLARES AND HARD X-RAY MICROFLARES
Robert P. Lin *In* NASA. Marshall Space Flight Center Solar Flares and Coronal Physics Using P/OF as a Research Tool Apr. 1986 p 98-119 refs (For primary document see N86-24614 14-92)
(Grants NAG5-376; NAGw-516; NGL-05-003-017; NSF ATM-84-02231)
Avail: NTIS HC A14/MF A01 CSCL 03B

Solar electron phenomena which can produce low levels of hard X-ray emission at the Sun are reviewed. Small approx. 2 to 100 keV solar electrons events, the most common type of impulsive solar particle emission, appear to originate in flare-like bursts high in the corona. These events often are accompanied by approx. 1 MeV/nucleon to the 3rd power He-rich particle events in which lower energy ions are apparently accelerated as well. Long-lived (many days) streams associated with large flares or interplanetary shocks dominate the interplanetary electron fluxes, but even at the quietest times a significant outflow of non-thermal approx. 2 keV electrons occurs. These electron phenomena are accompanied by coronal and interplanetary radio emission. High sensitivity hard X-ray measurements show that microflares, bursts with peak > keV fluxes 10 to 100 times smaller than observed in small solar flares, may occur as often as once every 5 min near solar maximum. The proposed Pinhole/Occulter Facility hard X-ray instrumentation provides the increase in sensitivity required to image these phenomena for the first time. Author

N86-24621*# California Univ., San Diego. Center for Astrophysics and Space Sciences.
OPTICAL IMAGING SPECTROSCOPY **c74**
Richard C. Canfield *In* NASA. Marshall Space Flight Center Solar Flares and Coronal Physics Using P/OF as a Research Tool Apr. 1986 p 120-131 refs (For primary document see N86-24614 14-92)
(Grants NsG-7406; NSF AST-83-20306; NSF ATM-84-15793; AF-AFOSR-3071-76; AF-AFOSR-0092-82)
Avail: NTIS HC A14/MF A01 CSCL 20F

During the recent solar maximum the combination of imaging and spectroscopy in the visible part of the spectrum became a powerful tool for observational study of flares primarily because of the development of two-dimensional charge-coupled-device (CCD) arrays. In combination with appropriate new operational methods, this has led to the ability to observe, for the first time, the preflare and impulsive-phase physical processes associated with spatially resolved features of flare loops. As a result of concurrent theoretical developments, modeling progressed from an empirical to a physical level. This made it possible to interpret imaging spectra in terms of coronal pressure and heat flux, particle beam heating, chromospheric evaporation, and explosive chromospheric dynamics at the footpoints of flare loops. There is clear potential for further advances in the near future, taking advantage of improvements in digital recording speed (approx. 10-fold), number of photosensitive elements per array (approx. 10-fold), real-time data pre-reduction (potentially 10- to 100-fold), and using multiple CCD arrays. By the time of the next solar maximum imaging spectroscopy is expected to achieve spatial resolution < or approx. arc 1 arc s, temporal resolution < or approx. 5 s, and simultaneous critically-sampled spectroscopy of several lines and continua. As a result, continued increase in our understanding of the physical processes and configurations of solar flares in the chromosphere, temperature minimum region, and photosphere can be anticipated. Even greater progress toward a more global understanding of flares will obviously come about when simultaneous optical, X-ray, and gamma-ray imaging spectroscopy are possible. Author

N86-24622*# Alabama Univ., Huntsville. Dept. of Physics.
THEORETICAL MOTIVATION FOR HIGH SPATIAL RESOLUTION, HARD X-RAY OBSERVATIONS DURING SOLAR FLARES
A. Gordon Emslie *In* NASA. Marshall Space Flight Center Solar Flares and Coronal Physics Using P/OF as a Research Tool Apr. 1986 p 132-138 refs (For primary document see N86-24614 14-92)
Avail: NTIS HC A14/MF A01 CSCL 03B

The important role played by hard X-ray radiation as a diagnostic of impulsive phase energy transport mechanism is reviewed. It is argued that the sub-arc second resolution offered by an instrument such as the Pinhole/Occulter Facility (P/OF) can greatly increase our understanding of such mechanisms. Author

N86-24623*# Berkeley Research Associates, Inc., Calif.
THE ROLE OF HIGH RESOLUTION OBSERVATIONS IN DETERMINING ENERGY RELEASE AND TRANSPORT PROCESSES
Dean F. Smith *In* NASA. Marshall Space Flight Center Solar Flares and Coronal Physics Using P/OF as a Research Tool Apr. 1986 p 139-141 refs Prepared in cooperation with Colorado Univ., Boulder (For primary document see N86-24614 14-92)
(Contract NASw-3603; Grant NSF ATM-83-14511)
Avail: NTIS HC A14/MF A01 CSCL 03B

With present observations from the Solar Maximum Mission, we are seeing a very selective sample of spatially large flares in the soft part (10 to 50 keV) of the hard X-ray spectrum. The spatial resolution is at best 5600 km with a corresponding time resolution of 4.5 s for adequate count statistics. This resolution gives rise to the following problems: We cannot resolve the minor radii of the loops involved or tell where and how the energy release occurs. The manner in which loops interact and the relationship between the soft and hard > or approx 00 keV) parts of hard X-rays remains elusive. We cannot see how energy propagates in most cases. Thus it is desirable to determine the minimum increase in spatial and temporal resolution required to solve these problems. Spatially we need to resolve the minor radius of a small loop which is about 800 km or 1 arc s. Upper limits to observed speeds of conduction fronts and shocks are approx km/s with theoretical limits running about a factor of 2 higher. Thus, a compatible minimum time resolution is in the range of 0.2 to 0.4 s. With these spatial and temporal resolutions, sufficient count statistics are required to go up to approx 120 keV with a sufficient number of energy bands to obtain spectra. Author

N86-24624*# Air Force Geophysics Lab., Hanscom AFB, Mass. National Solar Observatory.
WHY P/OF SHOULD LOOK FOR EVIDENCES OF OVER-DENSE STRUCTURES IN SOLAR FLARE HARD X-RAY SOURCES
Donald F. Neidig, Sharad R. Kane (California Univ., Berkeley), J. J. Love (California Univ., Berkeley), and E. W. Cliver *In* NASA. Marshall Space Flight Center Solar Flares and Coronal Physics Using P/OF as a Research Tool Apr. 1986 p 142-145 refs (For primary document see N86-24614 14-92)
Avail: NTIS HC A14/MF A01 CSCL 03B

White-light and hard X-ray (HXR) observations of two white-light flares (WLFs) show that if the radiative losses in the optical continuum are powered by fast electrons directly heating the WLF source, then the column density constraints imposed by the finite range of the electrons requires that the WLF consist of an over-dense region in the chromosphere, with density exceeding 10 to the 14th power/cu cm. Thus, we recommend that P/OF search for evidences of over-dense structures in HXR images obtained simultaneously with optical observations of flares. Author

N86-24625*# California Univ., Berkeley. Space Sciences Lab.
THE HEATING OF THE THERMAL PLASMA WITH ENERGETIC ELECTRONS IN SMALL SOLAR FLARES
Hua-An Lin and Robert P. Lin *In* NASA. Marshall Space Flight Center Solar Flares and Coronal Physics Using P/OF as a Research Tool Apr. 1986 p 146-149 refs (For primary document see N86-24614 14-92)
(Grant NAG5-376)
Avail: NTIS HC A14/MF A01 CSCL 03B

The energetic electrons deduced from hard X-rays in the thick target model may be responsible for heating of soft X-ray plasma in solar flares. It is shown from OSO-7 studies that if a cutoff of 10 keV is assumed, the total electron is comparable to the thermal plasma energy. However, (1) the soft X-ray emission often appears to begin before the hard X-ray burst, (2) in about one-third of flares there is no detectable hard X-ray emission, and (3) for most events the energy content (assuming constant density) of soft X-ray plasma continues to rise after the end of the hard X-ray burst. To understand these problems we have analyzed the temporal relationship between soft X-rays and hard X-rays for 20 small events observed by ISEE-3 during 1980. One example is shown. The start of soft X-ray and hard X-ray bursts is defined as the time when the counting rates of the 4.8 to 5. keV and 25.8 to 43.2 keV channels, respectively, exceed the background by one standard deviation. Author

N86-24626*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
HARD X-RAY IMAGING AND THE RELATIVE CONTRIBUTION OF THERMAL AND NONTHERMAL EMISSION IN FLARES
Gordon D. Holman *In* NASA. Marshall Space Flight Center Solar Flares and Coronal Physics Using P/OF as a Research Tool Apr. 1986 p 150-157 refs (For primary document see N86-24614 14-92)
Avail: NTIS HC A14/MF A01 CSCL 03B

The question of whether the impulsive 25 to 100 keV X-ray emission from solar flares is thermal or nonthermal has been a long-standing controversy. Both thermal and nonthermal (beam) models have been developed and applied to the hard X-ray data. It now seems likely that both thermal and nonthermal emission have been observed at hard X-ray energies. The Hinotori classification scheme, for example, is an attempt to associate the thermal-nonthermal characteristics of flare hard X-ray emission with other flare properties. From a theoretical point of view, it is difficult to generate energetic, nonthermal electrons without dumping an equal or greater amount of energy into plasma heating. On the other hand, any impulsive heating process will invariably generate at least some nonthermal particles. Hence, strictly speaking, although thermal or nonthermal emission may dominate the hard X-ray emission in a given energy range for a given flare, there is no such thing as a purely thermal or nonthermal flare mechanism. Author

N86-24627*# Stanford Univ., Calif. Center for Space Science and Astrophysics.
SUPER ACTIVE REGIONS AND PRODUCTION OF MAJOR SOLAR FLARES
Taeil Bai *In* NASA. Marshall Space Flight Center Solar Flares and Coronal Physics Using P/OF as a Research Tool Apr. 1986 p 153-157 refs (For primary document see N86-24614 14-92)
(Grants NAGw-92; HGL-05-020-272; Contract N00014-75-C-0673)
Avail: NTIS HC A14/MF A01 CSCL 03B

The success of imaging detectors with small fields of veiw such as HXIS or P/OF (Pinhole/Occulter Facility) depends heavily on pointing to the right place at the right time. During the solar maximum years many active regions coexist on the solar disk. Therefore, in order to point the imaging detector to the right place, it is important to know which active region is most likely to produce major flares. This knowledge is also important for flare prediction. As a first step toward this goal active regions have been identified which produced major flares observed by HXRBS (Hard X-Ray Burst Spectrometer) on SMM during February 1980 through December 1983. For this study the HXRBS Event List, an updated flare list compiled by the HXRBS group, and the Comprehensive Reports of the Solar Geophysical Data were used. During this period, HXRBS detected hard X-rays from approx 7000 solar flares, out of which only 441 flares produced X-rays with peak count rates exceeding 1000 counts/s. Flares with such high peak count rates are major flares. During the same time period about 2100 active regions passed across the solar disk, out of which only 153 were observed to produce major flares. (Some active regions are known to persist for several solar rotations, but at each passage new active region numbers are assigned and the estimate is based on active region numbers.) Out of these 153 active regions, 25 were observed to produce 5 or more major flares. Considering their high productivity of major flares, we may call these active regions super active regions. These 25 super active regions produced 209 major flares, accounting for 51% of all the major flares with identified active regions. Author

N86-24628*# Observatoire de Paris-Meudon (France).
THE SOLAR RADIO CORONA: MANIFESTATIONS OF ENERGETIC ELECTRONS
Monique Pick *In* NASA. Marshall Space Flight Center Solar Flares and Coronal Physics Using P/OF as a Research Tool Apr.

1986 p 159-177 refs (For primary document see N86-24614 14-92)
Avail: NTIS HC A14/MF A01 CSCL 03B

Radio observations are powerful tools which are complementary to the space missions devoted to the physics of the flares, of the corona, or of the interplanetary medium. To undertake this task two multifrequency radioheliographs presently exist: the Nancay instrument (the multifrequency facility will be in operation by the end of 1985) observes the middle corona at decimeter-meter wavelengths, and the Clark Lake radioheliograph, operating at decameter wavelengths, is the only one in the world to have the ability of observing the outer corona above the disk. Author

N86-24629*# Colorado Univ., Boulder. Dept. of Astrophysical, Planetary and Atmospheric Sciences.
RADIO IMAGING OF FLARES c90
George A. Dulk *In* NASA. Marshall Space Flight Center Solar Flares and Coronal Physics Using P/OF as a Research Tool Apr. 1986 p 178-190 refs (For primary document see N86-24614 14-92)
(Grants NsG-7287; NAGw-91)
Avail: NTIS HC A14/MF A01 CSCL 03B

High resolution (arcseconds to ten of arcseconds) mapping of solar microwave bursts has recently been achieved. The properties of the radio images that have been reported and, so far as possible, the relation of the radio sources to X-ray observations of the same flares are discussed. Author

N86-24630*# California Inst. of Tech., Pasadena.
HIGH-SPECTRAL RESOLUTION SOLAR MICROWAVE OBSERVATIONS
Gordon J. Hurford *In* NASA. Marshall Space Flight Center Solar Flares and Coronal Physics Using P/OF as a Research Tool Apr. 1986 p 191-200 refs (For primary document see N86-24614 14-92)
(Contract F19628-84-K-0023; Grants NSF AST-83-15217; NSF ATM-83-09955)
Avail: NTIS HC A14/MF A01 CSCL 03B

The application of high-spectral resolution microwave observations to the study of solar activity is discussed with particular emphasis on the frequency dependence of microwave emission from solar active regions. A shell model of gyroresonance emission from active regions is described which suggest that high-spectral resolution, spatially-resolved observations can provide quantitative information about the magnetic field distribution at the base of the corona. Corresponding observations of a single sunspot with the Owens Valley frequency-agile interferometer at 56 frequencies between 1.2 and 14 Ghs are presented. The overall form of the observed size and brightness temperature spectra was consistent with expectations based on the shell model, although there were differences of potential physical significance. The merits and weaknesses of microwave spectroscopy as a technique for measuring magnetic fields in the solar corona are briefly discussed. Author

N86-24631*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
SINGLE-DISH HIGH SENSITIVITY DETERMINATION OF SOLAR LIMB EMISSION AT 22 AND 44 GHz
J. E. R. Costa, J. L. Homor, and P. Kaufmann *In* NASA. Marshall Space Flight Center Solar Flares and Coronal Physics Using P/OF as a Research Tool Apr. 1986 p 201-207 refs Original language document was announced as N85-30999 Sponsored in part by FINEP and FAPESP, Brazil (For primary document see N86-24614 14-92)
Avail: NTIS HC A14/MF A01 CSCL 03B

A large number of solar maps were obtained with the use of Itapetinga 45 ft antenna at 22 GHz and 44 GHz. A statistical study of these maps, reduced using original techniques, permitted the establishment of the solar radius with great accuracy at the two frequencies. It is found that 22 GHz and 44 BHz radiation originates at 16,00 km and 12,500 km above the photosphere, respectively. Excess emission due to active regions was clearly identified at lower solar latitudes above and below the equator, extending up to 26,000 km and 16,500 km above the photosphere, at 22 GHs and 44 GHz, respectively. Author

N86-24632*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
SHORT-LIVED SOLAR BURST SPECTRAL COMPONENT AT f APPROXIMATELY > 100 GHz
P. Kaufmann, E. Correia, J. E. R. Costa, and A. M. Zodi Vaz *In* NASA. Marshall Space Flight Center Solar Flares and Coronal Physics Using P/OF as a Research Tool Apr. 1986 p 208-214 refs Original language document was announced as N86-16178 Sponsored in part by FINEP, Brazil (For primary document see N86-24614 14-92)
Avail: NTIS HC A14/MF A01 CSCL 03B

A new kind of burst emission component was discovered, exhibiting fast and distinct pulses (approx. 60 ms durations), with spectral peak emission at f approx. 100 GHz, and onset time coincident to hard X-rays to within approx. 128 ms. These features pose serious constraints for the interpretation using current models. One suggestion assumes the f approx. 100 GHz pulses emission by synchrotron mechanism of electrons accelerated to ultrarelativistic energies. The hard X-rays originate from inverse Compton scattering of the electrons on the synchrotron photons. Several crucial observational tests are needed for the understanding of the phenomenon, requiring high sensitivity and high time resolution (approx. 1 ms) simultaneous to high spatial resolution (0.1 arcsec) at f approx. 110 GHz and hard X-rays. Author

N86-24633*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
POLAR-CAP AND CORONAL-HOLE-ASSOCIATED BRIGHTENINGS OF THE SUN AT MILLIMETER WAVELENGTHS
T. Kosugi, M. Ishiguro (Nobeyama Radio Observatory, Nagano, Japan), and K. Shibasaki (Nagoya Univ., Japan) *In* NASA. Marshall Space Flight Center Solar Flares and Coronal Physics Using P/OF as a Research Tool Apr. 1986 p 215-219 refs Submitted for publication (For primary document see N86-24614 14-92)
Avail: NTIS HC A14/MF A01 CSCL 03B

Mapping observations of the Sun at millimeter wavelengths were made on 16 to 22 July 1984 with the 45-m telescope of the Nobeyama Radio Observatory. Seven 36-GHz (8.3-mm) maps and five 98-GHz (3.1-mm) maps were taken with half-power beam widths of 46 arc sec and 17 arc sec, respectively. Instead of the conventional rastering technique, a radial-scan method was adopted in which every scan passes through the disk center. Accordingly, the variation of the atmosphere attenuation due to changes in the weather conditions can be easily estimated and removed by using the brightness values at the disk center as calibration data. Also, the pointing errors of the telescope due to the high-speed scans can be corrected by using the solar limbs as position references. The rms residual errors in relative brightness and position after the corrections were estimated to be approx. 2% and approx. 5 arc sec respectively. To further reduce these errors, enabled us to make high-quality maps with with < or approx. 1% uncertainty in brightness. Here and in the following, brightness is expressed in terms of the average brightness of the solar disk as a unit. Note that the brightness temperature of the quiet Sun is approx. 8000 K and approx. 6000 K at 36 GHz and 98 GHz, respectively. Author

N86-24634*# Harvard-Smithsonian Center for Astrophysics, Cambridge, Mass.
CORONA AND SOLAR WIND
George L. Withbroe *In* NASA. Marshall Space Flight Center Solar Flares and Coronal Physics Using P/OF as a Research Tool Apr. 1986 p 221-240 refs (For primary document see N86-24614 14-92)
(Grant NAGw-249)
Avail: NTIS HC A14/MF A01 CSCL 03B

The Pinhole/Occulter Facility is a powerful tool for studying the physics of the extended corona and origins of the solar wind. Spectroscopic data acquired by the P/OF coronal instruments can

greatly expand empirical information about temperatures, densities, flow velocities, magnetic fields, and chemical abundances in the corona out to r > or approx. 10 solar radii. Such information is needed to provide tight empirical constraints on critical physical processes involved in the transport and dissipation of energy and momentum, the heating and acceleration of plasma, and the acceleration of energetic particles. Because of its high sensitivity, high spatial and temporal resolutions, and powerful capabilities for plasma diagnostics, P/OF can significantly increase our empirical knowledge about coronal streamers and transients and thereby advance the understanding of the physics of these phenomena. P/OF observations can be used to establish the role in solar wind generation, if any, of small-scale dynamical phenomena, such as spicules, macrospicules and coronal bullets, and the role of the fine-scale structures, such as polar plumes. Finally, simultaneous measurements by the P/OF coronal and hard X-ray instruments can provide critical empirical information concerning nonthermal energy releases and acceleration of energetic particles in the corona. Author

N86-24635*# Naval Research Lab., Washington, D. C. Center for Space Research.
SOLWIND OBSERVATIONS OF CORONAL MASS EJECTIONS DURING 1979-1985
N. R. Sheeley, Jr., R. A. Howard, M. J. Koomen (Sachs/Freeman Associates, Bowie, Md.), and D. J. Michels *In* NASA. Marshall Space Flight Center Solar Flares and Coronal Physics Using P/OF as a Research Tool Apr. 1986 p 241-256 refs (For primary document see N86-24614 14-92)
Avail: NTIS HC A14/MF A01 CSCL 03B

Coronal observations have been processed for parts of each year during the interval 1979-1985. Around sunspot maximum, coronal mass ejections (CMEs) occurred at the rate of approximately 2 per day, and had a wide range of physical and morphological properties. During the recent years of relatively low sunspot number, CMEs occurred at the rate of only 0.2 per day, and were dominated by the class of so-called streamer blowout. These special CMEs maintained a nearly constant occurrence rate of roughly 0.1 per day during the entire interval. Author

N86-24636*# National Center for Atmospheric Research, Boulder, Colo. High Altitude Observatory.
INTERPRETATION OF CORONAL SYNOPTIC OBSERVATIONS
Richard H. Munro and Richard R. Fisher *In* NASA. Marshall Space Flight Center Solar Flares and Coronal Physics Using P/OF as a Research Tool Apr. 1986 p 257-261 refs (For primary document see N86-24614 14-92)
Avail: NTIS HC A14/MF A01 CSCL 03B

Three-dimensional reconstruction techniques used to determine coronal density distributions from synoptic data are complicated and time consuming to employ. Current techniques also assume time invariant structures and thus mix both temporal and spatial variations present in the coronal data. The observed distribution of polarized brightness, pB, and brightness, B, of coronal features observed either at eclipses or with coronagraphs depends upon both the three-dimensional distribution of electron density within the structure and the location of the feature with respect to the plane-of-the-sky. By theoretically studying the signature of various coronal structures as they would appear during a limb transit, it is possible to recognize these patterns in real synoptic data as well as estimate temporal evolutionary effects. Author

N86-24637*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
WAVE SPEEDS IN THE CORONA AND THE DYNAMICS OF MASS EJECTIONS
Steven T. Suess and Ronald L. Moore *In its* Solar Flares and Coronal Physics Using P/OF as a Research Tool Apr. 1986 p 262-267 refs (For primary document see N86-24614 14-92)
Avail: NTIS HC A14/MF A01 CSCL 03B

A disturbance or coronal mass ejection being advected by the solar wind will expand at the fastest local characteristic speed - typically approximately the fast-mode speed. To estimate this characteristic wave speed and the velocity field in the ambient corona, it is necessary to know the magnetic field, temperature, and density. Only the density is known from coronal observations. The temperature, magnetic field, and velocity are not yet directly measured in the outer corona and must be estimated from a model. In this study, it is estimated that the magnetic field, solar wind velocity, and characteristic speeds use the MHD model of coronal expansion between 1 and 5 solar radii (R solar radii) with a dipole magnetic field at the base. This model, for a field strength of about 2 gauss at the base, gives flow speeds at low latitudes (near the heliospheric current sheet) of < 250 km/s at 5 R solar radii and, < 50 km/s at 2 solar radii, and fast-mode speeds to 400 to 500 km/s everywhere between 2 and 5 solar radii. This suggests that the outer edge of a velocity of mass ejection reported by MacQueen and Fisher (1983) and implies that the acceleration mechanism for coronal mass ejections is other than simple entrainment in the solar wind. Author

N86-24638*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ON THE FORMATION OF CORONAL CAVITIES
Chang-Hyuk An, Steven T. Suess, Einer Tandberg-Hanssen, and Richard S. Steinolfson (California Univ., Irvine) *In its* Solar Flares and Coronal Physics Using P/OF as a Research Tool Apr. 1986 p 268-273 refs Sponsored in part by NAS-NRC (For primary document see N86-24614 14-92)
Avail: NTIS HC A14/MF A01 CSCL 03B

A theoretical study of the formation of a coronal cavity and its relation to a quiescent prominence is presented. It is argued that the formation of a cavity is initiated by the condensation of plasma which is trapped by the coronal magnetic field in a closed streamer and which then flows down to the chromosphere along the field lines due to lack of stable magnetic support against gravity. The existence of a coronal cavity depends on the coronal magnetic field strength; with low strength, the plasma density is not high enough for condensation to occur. Furthermore, we suggest that prominence and cavity material is supplied from the chromospheric level. Whether a coronal cavity and a prominence coexist depends on the magnetic field configuration; a prominence requires stable magnetic support. Author

N86-24639*# Naval Research Lab., Washington, D. C. Center for Space Research.
THE PINHOLE/OCCULTER AS A TOOL FOR X-RAY ASTRONOMY c89
Kent S. Wood *In* NASA. Marshall Space Flight Center Solar Flares and Coronal Physics Using P/OF as a Research Tool Apr. 1986 p 277-295 refs (For primary document see N86-24614 14-92)
Avail: NTIS HC A14/MF A01 CSCL 03A

The two X-ray transform telescopes on the Pinhole/Occulter Facility (P/OF) will provide sub-arcsecond angular resolution, high sensitivity imaging in hard X-rays for the first time, as well as improved capabilities for timing studies and spectroscopy. Although the design was driven by solar observing requirements, the result is an instrument of major importance for astronomical as well as solar observations. Fundamental astrophysical measurements could be made on supernova remnants, clusters of galaxies, active galaxy cores, accreting binary systems, and active coronae of nearby stars. Ways in which astronomical observations will benefit solar research are discussed. Author

N86-24640# California Inst. of Tech., Pasadena.
APPLICATION OF MICROWAVE SPECTROSCOPY TO THE STUDY OF CORONAL FIELD CHANGES ASSOCIATED WITH A DISAPPEARING SUNSPOT
G. J. Hurford Mar. 1985 18 p
(Contract F19628-84-K-0023)
(AD-A162191; AFGL-TR-85-0092; SR-1) Avail: NTIS HC A02/MF A01 CSCL 03/2

A critical physical parameter affecting solar activity is the distribution of coronal magnetic fields. Microwave observations provide the only technique for the quantitative measurement of

these fields. This report presents the preliminary analysis of high spatial and spectral resolution observations designed to measure the distribution and evolution of the coronal magnetic fields of a disappearing sunspot. Data at 56 frequencies between 1.2 and 14 GHz were acquired with the three-element frequency-agile interferometer. This system directly measured the size of coronal microwave sources at each frequency and polarization. The temperature of the source was determined from the ratio of source flux to area. This yielded the size and brightness temperature spectra of the microwave sources associated with a sunspot as it disappeared over three successive days. On the basis of gyroresonance opacity, the corona would be expected to be opaque at microwave frequencies at surfaces corresponding to specific values of coronal field strength. GRA

N86-24641# Aerospace Corp., El Segundo, Calif. Space Sciences Lab.

X-RAY LINE RATIOS FOR fe 17 OBSERVED IN THE SOLAR CORONA

Hugo R. Rugge and David L. McKenzie 2 Dec. 1985 36 p
(Contract F04701-85-C-0086)
(AD-A162320; TR-0086(6940-01)-1; SD-TR-85-86) Avail: NTIS HC A03/MF A01 CSCL 03/2

Selected solar spectra from the SOLEX B X-ray spectrometers aboard the USAF P78-1 satellite were analyzed in order to compare Fe XVII line flux ratios with theory. The spectra were chosen to cover a wide range of solar activity from quiescent active regions to large flares. For purposes of comparison with theory, a temperature scale based on a ratio of Fe XVIII to Fe XVII line fluxes has been derived. Fe XVII line ratios involving one line with a 3s outer electron in the upper state and the other with a 3d electron are potentially the most useful, since such ratios are predicted, by theory, to have a significant temperature dependence. The data do not support the theoretical predictions. The dependence of the 3s/3d line ratios on temperature is found to be very weak, and the ratios are unlikely to be useful as temperature diagnostics. Measurements of the ratios involving only 3s upper levels or only 3d upper levels also disagree with theory. Improved theoretical calculations are needed to interpret the large amount of high-quality data that are now becoming available. Resonance scattering. GRA

N86-24642*# Stanford Univ., Calif. Center for Space Science and Astrophysics.

CONFIRMATION OF A 152-DAY PERIODICITY IN THE OCCURRENCE OF SOLAR FLARES INFERRED FROM MICROWAVE DATA

Richard S. Bogart and Taeil Bai Sep. 1985 12 p Previously announced in IAA as A86-20333
(Grants NGL-05-020-272; NAGw-92; Contract N00014-76-C-0207; N00014-85-K-0111; Grant NSF ATM-77-20580)
(NASA-CR-176755; NAS 1.26:176755; AD-A163091; SU-CSSA-ASTRO-85-20) Avail: NTIS HC A02/MF A01 CSCL 03B

Evidence for a periodicity of about 155 + or - 5 days in the production of energetic solar flares has been reported by Rieger et al. (1984) and Kiplinger et al. (1984). The data on which these analyses were based are restricted to the years 1980 through early 1984. To see whether this periodicity is a persistent phenomenon, we have examined the occurrences of flares inferred from microwave data, which are available for most of the present and previous solar cycles. We find strong confirmation of a 152-day periodicity in the time interval previously studied, demonstrating that these flares are a useful indicator for the observed periodicity. We find evidence for persistence of the periodicity in the previous cycle (Cycle 20). In Cycle 20 the periodic modulation of the flare occurrence rate was weaker than in Cycle 21, but the phase has apparently remained coherent through both cycles. GRA

N86-24643*# Stanford Univ., Calif. Center for Space Science and Astrophysics.

SUPER-ACTIVE REGIONS AND PRODUCTION OF MAJOR SOLAR FLARES

Taeil Bai Oct. 1985 8 p
(Grants NGL-05-020-272; NAGw-92; Contract N00014-85-K-0111) (NASA-CR-176768; NAS 1.26:176768; AD-A163104; SU-CSSA-ASTRO-85-24) Avail: NTIS HC A02/MF A01 CSCL 03B

The success of imaging detectors with small fields of view such as HXIS or the Pinhole/Occulter Facility (P/OF) depends strongly on the ability to point the right place at the right time. During solar maximum years many active regions coexist on the solar disk. Therefore, in order the imaging detector to the right plane, it is important to know which active region is most likely to produce major flares. This knowledge is also important for flare prediction. GRA

N86-24644*# Stanford Univ., Calif. Center for Space Science and Astrophysics.

TWO CLASSES OF GAMMA-RAY/PROTON FLARES: IMPULSIVE AND GRADUAL. REVISION

Taeil Bai Nov. 1985 59 p
(Grants NGL-05-020-272; NAGw-92; Contract N00014-85-K-0111) (NASA-CR-176769; NAS 1.26:176769; AD-A163105; SU-CSSA-ASTRO-85-26-Rev) Avail: NTIS HC A04/MF A01 CSCL 03B

We have studied various properties of gamma ray/proton flares, which produce nuclear gamma rays and/or interplanetary energetic protons. We have found that there exist two classes of gamma ray/proton (GR/P) flares, with each class having many distinct characteristics in common. Gradual GR/P flares (so named because of gradual variations of hard X-ray fluxes with duration of spike bursts longer than 90 s) have the following characteristics: long duration (> 10 min) hard/X-ray and microwave emission, gradual variation of microwave flux, relatively large ratios of microwave to hard X-ray fluxes, large H-alpha areas, long-duration soft X-ray emission (> 1 hr), hard X-ray emission from extended coronal loops, interplanetary type II emission, coronal mass ejections, and production of large numbers of interplanetary energetic protons. Impulsive GR/P flares display directly opposing behavior in the above respects. However, the two classes of GR/P flares have a few characteristics common to both of them. GRA

N86-24645# Max-Planck-Inst. fuer Aeronomie, Katlenburg-Lindau (West Germany).

SUPERPOSED EPOCH ANALYSIS OF COROTATING INTERACTION REGIONS (CIR), AT 0.3 AND 1.0 AU: A COMPARATIVE STUDY

A. K. Richter and A. H. Luttrell Sep. 1985 20 p refs Revised (MPAE-W-79-85-03) Avail: NTIS HC A02/MF A01

The superposed epoch analysis technique was applied to 16 and to 31 well defined, nonshock associated stream-stream interaction regions observed by HELIOS 1 and 2 between 0.3 and 0.4 AU and between 0.9 and 1.0 AU, respectively, to obtain the average azimuthal variations of the solar wind density, velocity and temperature of the magnetic field strength, and of the total proton plasma plus magnetic field pressure at these two radial distances. For the radial evolution of these interaction regions, comparison shows that due to compressional and rarefactional effects, the amplitudes of all parameters along the leading and trailing parts of the interaction steadily increase, with the most pronounced increase in pressure. The leading portion of the velocity profile steepens. Positions in azimuth of the overall maximum values of the solar wind density and temperature, of the magnetic field strength and of the plasma plus magnetic field pressure get lined-up in longitude. The leading portions of all profiles steepen into discontinuous, shock-like structures.
Author (ESA)

N86-24646# National Oceanic and Atmospheric Administration, Silver Spring, Md. Air Resources Lab.

SOLAR RADIATION AT THE BARROW, ALASKA, GMCC (GEOPHYSICAL MONITORING FOR CLIMATIC CHANGE) BASELINE OBSERVATORY, 1976-1983

E. G. Dutton, J. J. DeLuisi, and D. J. Endres Aug. 1985 121 p
(PB86-110087; NOAA-DR-ERL-ARL-6) Avail: NTIS

HC A06/MF A01 CSCL 04A

Details of, and data from, an ongoing solar radiation measurement program administered by NOAA/Geophysical Monitoring for climatic Change from 1976 through 1983 are presented. The data include daily sums of downward global solar flux and discrete measurements of direct beam solar flux in clear skies. Also included are the data for passive remote sensing of atmospheric aerosol properties, using the Sun as a source. The remote sensing measurements were made in the spring of 1982 and 1983. Data are presented in reduced form such that direct application to research studies can be made. GRA

93 SPACE RADIATION

Includes cosmic radiation; and inner and outer Earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N86-24647 California Univ., Berkeley.
A MEASUREMENT OF THE COSMIC BACKGROUND RADIATION TEMPERATURE AT 3.3 mm WAVELENGTH Ph.D. Thesis
Chris Witebsky 1985 165 p
Avail: Univ. Microfilms Order No. DA8525158

Measurements of the cosmic background radiation (CBR) at 3.3 mm wavelength (90 GHz) have yielded a brightness temperature of 2.57 with a 1 sigma uncertainty of + or - 0.12 K. The observations were made from the Barcroft Laboratory of the White Mountain Research Station, at an altitude of 3800 m, initially on 5 and 6 July 1982 and again on 4, 5, and 6 September 1983, as part of a program to measure the spectrum of the CBR at five wavelengths from 12.0 cm to 3.3 mm. The weighted mean of the temperature mesurements at all five wavelengths is 2.72 + or - 0.04 K. The instrument used for the 3.3-mm measurements is a differential, dual-antenna, Dicke-switched, superheterodyne radiometer. Simultaneous zenith scans at 9.1 and 3.3 mm were used to check the atmospheric models of Waters and Liebe. Neither model predicts the correct relationship between atmospheric emission at 9.1 and 3.3. mm. When the results are combined with other measurements of the CBR temperature, the resulting spectrum is consistent with a 2.72 + or - 0.02 K blackbody.
Dissert. Abstr.

N86-24648 Wisconsin Univ., Madison.
ANALYSIS OF ASTRONOMICALLY-INDUCED MONTHLY AND ZONALLY AVERAGED EXTRA-ATMOSPHERIC IRRADIANCE VARIATIONS FOR THE LAST 500,000 YEARS Ph.D. Thesis
Edward John Hopkins 1985 956 p
Avail: Univ. Microfilms Order No. DA8516763

Zonally and temporally averaged irradiance and illumination geometry data and their annaul and long term variability are produced in greater detail than previously available. The computational algorithm (the HELIO-DAY algorithm) evaluates zonally averaged irradiance data and supporting information describing the latitudinally dependent illumination geometry (solar zenith angles and daylight duration) on a daily basis, provided an input of mean annual orbital elements applicable to the epoch are inserted; numerical summation of each day's irradiation witnin an interval generates multiday average irradiance for any zone. The accuracy of this methodology was tested with results consistent with theoretical evaluations. Using Berger's (l978) computational formulae to produce the time sequence of pertinent orbital elements, arrays of monthly and tri-monthly extra-atmospheric irradiance were produced by the HELIO-DAY algorithm.
Dissert. Abstr.

N86-24649 Texas Univ., Austin.
AN INVESTIGATION OF COSMIC RAY SCINTILLATIONS IN MUONS NEAR SEA LEVEL Ph.D. Thesis
Robert Henry Benson 1985 115 p
Avail: Univ. Microfilms Order No. DA8528302

An investigation of scintillations in ground-level cosmic ray muons has been conducted using a muon telescope constructed at Texas A&M University. The power density spectrum of the muon counting rate was calculated and the resultant slope of -1.36 is in excellent agreement with accepted theory. Dissert. Abstr.

N86-24650# Argonne National Lab., Ill.
UNDERGROUND MUONS FROM CYGNUS X-3
L. E. Price 1985 9 p refs Presented at the Meeting of the Particles and Fields Division of the American Physical Society, Eugene, Oreg., 12 Aug. 1985
(Contract W-31-109-eng-38)
(DE86-004055; CONF-850869-9) Avail: NTIS HC A02/MF A01

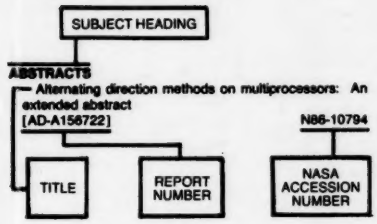
Underground detectors, intended for searches for nucleon decay and other rare processes, have recently begun searching for evidence of astrophysical sources, particularly Cygnus X-3, in the cosmic ray muons they record. Some evidence for signals from Cygnus X-3 has been reported. The underground observations are reported here in the context of previous (surface) observations of the source at high energies. DOE

99 GENERAL

N86-24651*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
REFORM OF GENERAL EDUCATION AND VOCATIONAL TRAINING IN THE U.S.S.R.
M. Leroy Spearman Mar. 1986 16 p refs
(NASA-TM-87693; NAS 1.15:87693) Avail: NTIS HC A02/MF A01 CSCL 05I

Extensive school reform measures were initiated in the U.S.S.R. in 1984. The essence of the reform is to improve the quality of instruction, improve the content of education, strengthen the Marxist-Leninist world view, and ensure that all secondary school graduates master an occupation. Author

Typical Subject Index Listing



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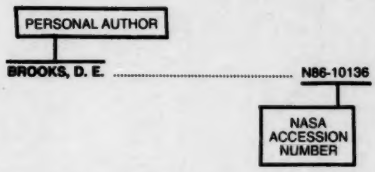

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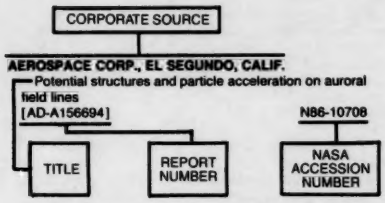

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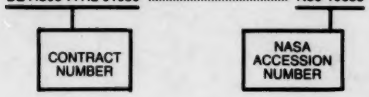

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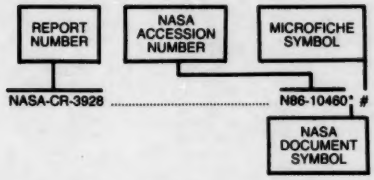

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AEDC-TR-85-30-VOL-1 ..... N86-23595 #
AEDC-TR-85-62 ..... N86-23876 #

AERE-G-3349-VOL-2 ..... N86-23832 #

AERE-M-3492 ..... N86-23719 #

AERE-R-11459 ..... N86-23717 #
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AERE-R-11923 ..... N86-23718 #

AFAMRL-TR-85-013 ..... N86-24223 #

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AFGL-ERP-916(2)-PT-2 ..... N86-23634 #
AFGL-ERP-917 ..... N86-24100 #
AFGL-ERP-922 ..... N86-24399 #

AFGL-TR-85-0040 ..... N86-24096 #
AFGL-TR-85-0092 ..... N86-24640 #
AFGL-TR-85-0102 ..... N86-24065 #
AFGL-TR-85-0103(2)-PT-2 ..... N86-23634 #
AFGL-TR-85-0121 ..... N86-24100 #
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AFHRL-TP-85-23 ..... N86-24194 #

AFHRL-TR-84-60 ..... N86-23596 #
AFHRL-TR-85-34 ..... N86-23804 #

AFIT/GSM/LSB/85S-22 ..... N86-24582 #

AFIT/GSM/LSQ/85S-23 ..... N86-24580 #
AFIT/GSM/LSQ/85S-27 ..... N86-24581 #

AFIT/GSM/LSY/85S-1 ..... N86-24576 #
AFIT/GSM/LSY/85S-15 ..... N86-24585 #
AFIT/GSM/LSY/85S-26 ..... N86-24583 #
AFIT/GSM/LSY/85S-28 ..... N86-24584 #
AFIT/GSM/LSY/85S-33 ..... N86-24568 #

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AFOSR-85-0874TR ..... N86-24342 #
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AFOSR-85-0959TR ..... N86-24296 #
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ISSN-0176-7739 ..... N86-24000 #
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ISSN-0721-5320 ..... N86-23585

ISVR-TR-129 ..... N86-24405 #
ISVR-TR-130 ..... N86-23955 #

JPRS-CST-86-005 ..... N86-23762 #

JPRS-JST-86-007 ..... N86-23773 #

JPRS-UMM-86-007 ..... N86-23768 #

JPRS-UPM-86-004 ..... N86-24358 #

JPRS-WST-86-015 ..... N86-24591 #

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K/CSD/TM-56 ..... N86-23884 #

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L-16025 ..... N86-23560* #
L-16062 ..... N86-23562* #
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LA-UR-85-3521 ..... N86-23905 #
LA-UR-85-3556 ..... N86-23923 #
LA-UR-85-3583 ..... N86-24283 #
LA-UR-85-3594 ..... N86-23683 #
LA-UR-85-3643 ..... N86-23907 #
LA-UR-85-3663 ..... N86-23906 #
LA-UR-85-3671 ..... N86-24108 #
LA-UR-85-3674 ..... N86-24475 #
LA-UR-85-3700 ..... N86-24443 #
LA-UR-85-3755 ..... N86-24262 #
LA-UR-85-3781 ..... N86-24284 #
LA-UR-85-3785 ..... N86-24432 #
LA-UR-85-3957 ..... N86-23925 #
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LA-10371-MS ..... N86-24210 #
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LA-10446-MS ..... N86-23909 #
LA-10454 ..... N86-24264 #
LA-10466-MS ..... N86-23829 #
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LA-10511-PR ..... N86-24448 #
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LBL-19828 ..... N86-23989 #
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LBL-20211 ..... N86-23713 #
LBL-20438 ..... N86-24609 #
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LC-84-27421 ..... N86-24006 #
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LC-85-600591 ..... N86-23833 #
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LCDS-84-39 ..... N86-24307 #
LCDS-85-12 ..... N86-24289 #
LCDS-85-23 ..... N86-24291 #

LCS-TR-6 ..... N86-24319 #

LDGO-85-7 ..... N86-24180 #
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LIDS-TH-1501 ..... N86-24214 #
LIDS-TH-1505 ..... N86-24309 #

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LMI-RE301 ..... N86-24589 #

LMSC/F035606 ..... N86-23997 #

LT-83-155 ..... N86-23586* #

M-506 ..... N86-24082* #
M-523 ..... N86-24614* #

MATRA-CMT-RS/101/RT/05.85 ..... N86-24272 #

MBB-UT-111/85 ..... N86-23714 #

MCR-85-813 ..... N86-23814 #
MCR-85-865 ..... N86-24237* #
MCR-85-1365 ..... N86-23611* #

MISC-2037 ..... N86-23582 #

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MM-4875-85-11 ..... N86-23631 #

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MPAE-W-79-85-03 ..... N86-24645 #

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MPO-100 ..... N86-23929 #
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NAE-AN-31 ..... N86-23608 #

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NAS 1.26:3675 ..... N86-23554* #
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NAS 1.71:MFS-28087-1 ..... N86-23899* #
NAS 1.71:NPO-16462-1CU ..... N86-24225* #
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NAVHLTHRSCHC-85-33 ..... N86-24206 #
NAVHLTHRSCHC-85-42 ..... N86-24207 #

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NBS/GCR-85/499 ..... N86-24555 #

NBS/SP-500/129 ..... N86-24274 #
NBS/SP-702 ..... N86-23715 #
NBS/SP-707 ..... N86-23833 #

NBS/TN-1077 ..... N86-23800 #
NBS/TN-1084 ..... N86-24463 #

NBSIR-84-2973 ..... N86-23840 #
NBSIR-85-3282 ..... N86-24014 #
NBSIR-85/3250 ..... N86-24275 #

NCAR/CT-94 ..... N86-24115 #

NEPRF-TR-85-03 ..... N86-24101 #

NLR-TR-84043-U-PT-1 ..... N86-23585
NLR-TR-84043-U-PT-2 ..... N86-23585
NLR-TR-85017-L-PT-1 ..... N86-23888 #
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NLR-TR-85017-L-PT-3 ..... N86-23890 #
NLR-TR-85017-L-PT-4 ..... N86-23891 #

NMERI-WA5-6(5.04) ..... N86-23607 #

NOAA-DR-ERL-ARL-6 ..... N86-24646 #

NOAA-DR-ERL-PMEL-12 ..... N86-24112 #

NOAA-NWS-WRCP-52 ..... N86-24117 #

NOAA-NWSTM-PR-28 ..... N86-24111 #

NOAA-TM-ERL-ESG-17 ..... N86-24113 #

NOAA-TM-ERL-PMEL-63 ..... N86-24183 #

NOAA-TM-NWS-HYDRO-41 ..... N86-24114 #

NOAA-TM-NWS-SR-114 ..... N86-24110 #

NOAA-TM-NWS-WR-191 ..... N86-24165 #

NORDA-TN-315 ..... N86-24173 #
NORDA-TN-318 ..... N86-24175 #

NORDA-101 ..... N86-24226 #
NORDA-103 ..... N86-24172 #
NORDA-120 ..... N86-24169 #

NOSC-TR-1037 ..... N86-24032 #

NOSC/TD-832 ..... N86-24549 #

NOSC/TR-1039 ..... N86-24188 #
NOSC/TR-1053 ..... N86-23877 #

NPRDC-TR-86-8 ..... N86-24215 #

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NPS67-85-010CR ..... N86-23633 #
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NRC-24882 ..... N86-23608 #

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NRL-MR-5644 ..... N86-24404 #
NRL-MR-5656 ..... N86-24064 #
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NRL-MR-5689 ..... N86-24326 #
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NRL-MR-5700 ..... N86-24426 #

NRL-8925 ..... N86-23784 #
NRL-8929 ..... N86-23817 #
NRL-8932 ..... N86-23874 #
NRL-8935 ..... N86-23818 #
NRL-8949 ..... N86-23793 #

NRLMR-5676 ..... N86-23590 #

NSF-DPP84-13028 ..... N86-24072 #

NSF-84-335 ..... N86-24554 #

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NSMRL-923 ..... N86-24402 #

NSWC/TR-85-228 ..... N86-24015 #

NUSC-TD-6448 ..... N86-23788 #

NUSC-TM-851054 ..... N86-24252 #

NUSC-TR-7511 ..... N86-24336 #

OMI-139 ..... N86-24095 #

ONRL-R-7-85 ..... N86-24288 #

ORNL/TM-9658 ..... N86-24263 #
ORNL/TM-9705 ..... N86-24477 #

OSD-771-HYDRO-CR-85-03 ..... N86-24099 #

PB86-103660 ..... N86-24073 #
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